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# PRACTICAL EXPERIENCES IN HARDNESS TESTING

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**Observations concerning the utility of various machines for measuring hardness, especially of sheet stock, in English metal-working shops**

BECAUSE OF the rapidity with which readings can be taken, and the smallness of the test sample, hardness testing machines are used widely both in engineering and in manufacturing. Much has been written on the subject, but chiefly from the theoretical standpoint. In the following article, therefore, the writer presents practical experiences with several of the most widely used types of hardness testers, for the benefit of those interested in raw materials and their relationship to manufacture, with special reference to press work.

A practical classification of hardness testing machines may be made as follows:

1. Indentation, such as the standard Brinell, Brinell Comparator, Pyramid, Rockwell, Alfred Herbert, and Hardometer
2. Rebound machines, such as the Scleroscope and the Alpha Rebondimeter
3. Ductility machines of the cupping variety, such as the Erichsen and the Erichsen-Olsen
4. Other machines, including the Herbert Pendulum and Cloudburst.

There are many other machines on the market, but the above are those used to a large extent in England. It does not follow, however, that machines not mentioned are not equally good, but simply that the writer has no first-hand knowledge of them.

Indentation hardness tests, in principle, consist of forcing a metal ball or similar point into the test sample under a definite load. The permanent indentation made depends upon the material tested, and upon the ratio of load applied to area. This ratio is usually taken as the indentation hardness, to an empirical scale. The principle just mentioned is utilized in many different types of machine, which differ greatly as regards mechanical features and modes of operation.

The Brinell was the first really successful hardness testing machine. A ball of 10 mm. diameter is utilized by the standard machine, which is capable of applying a load varying between 500 and 3,000 kg. Pressure is applied through the medium of an oil pump and is indicated on a dial gage. Since such instruments may be prone to variation, an arrangement is made whereby the actual load applied depends upon gravity.

The usual formula used for arriving at the Brinell figure is:

$$H = \frac{P}{\frac{\pi D}{2}\left[D - \sqrt{D^2 - d^2}\right]}$$

wherein $d$ is the diameter of the impression in millimetres, $H$ the Brinell hardness number, $D$ the diameter of the ball, and $P$ the load in kilograms.

The diameter of the impression is always measured by a microscope in the standard machine, the microscope being a separate unit of the set. Although some of the later machines measure depth of impression instead of diameter or width, there is much to be said in favor of the latter where a ball impression point is used. A simple examination of an indentation shows that the diameter is vary much greater than the depth in the majority of cases.

Although the Brinell is a reliable machine, when treated with care by an operator who knows something of the

principles involved, it has limitations. For instance, in cold weather the oil used increases in viscosity to such an extent that it becomes possible to secure quite erroneous results. Even when normal pumping speed is used, a load greater than the weights may be applied to the ball. It becomes necessary, therefore, to fit some heating device which will maintain the instrument and its oil contents at a uniform temperature when the room temperature varies, especially during cold nights. This applies especially to routine and not to laboratory tests.

Another fault is that, in some Brinell machines, there is no automatic control of the time element, including, as it does, the application of the load, impress duration and

load release. In certain cases this may have a distinct influence upon results.

Between 500 and 600 degrees on the Brinell scale, the indenting ball itself suffers measureable deformation. Readings fall considerably below those of a similar machine using a diamond point. The parallel may not be exact, but its truth is indicated by the fact that correction of the Brinell figure, as calculated by the usual formula when working between the limits previously mentioned, is required.

A consideration of the conditions obtaining during indentation indicates that the ratio of load to area must be kept within certain limits, and consequently that the size of ball used must be changed if the materials tested vary greatly in hardness. The ball diameter should be so chosen that the surface diameter of the impression lies between one-quarter and one-half the diameter of the ball itself. Commercially, the load and ball diameter are so arranged that the ratio of load to ball diameter remains approximately constant.

The microscope itself is by no means an ideal tool for the test shop. With shallow impressions it is sometimes difficult to determine the exact place at which the depression and the flat surface blend. To some extent, this can be remedied by the use of etched balls. On very thin materials, such as are used in light press work, the standard machine is of very little use, because the impression depth required exceeds the thickness of the metal.

In the "Baby" Brinell, a smaller and lighter type of machine working on principles similar to those of the standard machine, the mechanical details are considerably simplified. Smaller loads are applied, and, with care, reliable results can be obtained on material under 0.06 in. thick down to about 0.020 in. These figures are approximate only, for naturally they depend chiefly upon the actual hardness of the metals under test.

In passing, the Brinell Comparator may be mentioned. It is a simple device in which, by the use of bars of standard hardness and a ball, eye readings can be taken of the hardness of metals in place. Bars of hardness ranging from 150 to 700 Brinell are supplied. Observance of the principles employed makes it apparent that the whole device is rough in the extreme, yet an experienced man will come within plus or minus five per cent of the figure given by the standard machine with all its mechanical refinements. For the small factory the comparator is a useful addition which costs very little and may save much. It is, however, of no value for thin sheet material.

Firth's Hardometer operates on the same basic principles as the Brinell but incorporates mechanical simplifications. For the hard materials a diamond indenter is used to eliminate one of the errors previously mentioned. Instead of gravity and oil, a spring is used to apply the pressure. The chief practical advantage of the Hardometer lies in the fact that the microscope for taking the readings is attached to the machine itself. Several models are obtainable, but, in the opinion of the writer, those using vertical illumination are preferable. The spring loading arrangement, although apparently involving more error than a weight, in practice is actually better, for it eliminates inertia effects. The whole machine is a good and inexpensive job and may be used for materials down to about 0.016 in. thick if reasonable care is used.

Several new principles were introduced in the Rockwell machine, which is relatively new. It makes use of two distinct loads for each reading, the major and the minor. The latter, of 10 kg., is applied at the beginning of the test, the object being to take up all lost motion in the machine and to eliminate possible error introduced through bad surface contact with the specimen. The first impression serves to break through the skin of the specimen, which may be of different hardness from the layer immediate below. After the application of the minor load the major load of from 60 to 150 kg. is applied. Measurement is taken with the major load removed but the minor still applied.

All measurements are taken on a depth basis and are read direct from a dial gage. The rate of application of loads is governed by an oil dash-pot which introduces the time factor.

TWO different scales, termed *B* and *C*, are used. A steel ball, usually of $\frac{1}{16}$-in. diameter, or a diamond point having an angle of 120 deg. and a spherical tip of 0.2 mm. radius is employed. The usual loadings are 100 kg. for the ball point and 150 for the diamond. The scales are different from the Brinell but are, to some extent, reducible to it. Where the *B* and *C* scales overlap converted Brinell figures are likely to be very misleading.

Although mechanically the Rockwell machine is sound, in the experience of the writer, its use involves the disadvantage that the trade is more familiar with the Brinell scale, and Rockwell and Brinell numbers do not harmonize. It seems a pity that the machine should have been designed to produce a new scale of hardness figures. Another difficulty arises from the fact that the Rockwell scale is much coarser in places than the Brinell. In the proximity of 600 Brinell one degree Rockwell equals twelve Brinell. This causes confusion in the toolroom. It is not good practice to use the Rockwell machine for

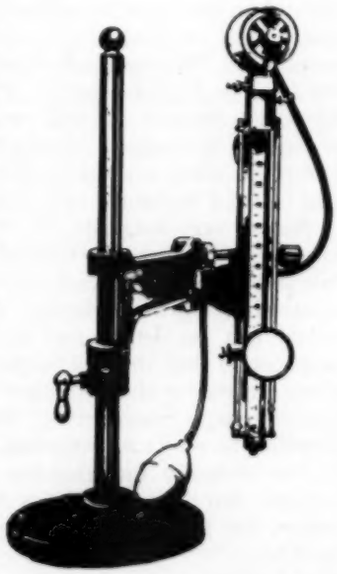
materials less than 0.040 in. thick unless the material tested is very hard.

Vickers Diamond Pyramid testers operate on the same principle as the Brinell machine but there is a marked difference in the indenter, the method of load application, and the measurement of the impression. Under ideal conditions the diameter of the ball impression in the standard Brinell machine should be three-eighths the diameter of the ball. This fact has been utilized in the design of the Pyramid machine, in which the majority of tests are made with a diamond pyramid having a 136 deg. entrance angle included between intersecting tangents at the extremities of a chordal distance equal to three-eighths the ball diameter. This form of indenter gives results true to the Brinell scale except in the higher readings, where normally the steel ball of the older machine becomes flattened, as mentioned above.

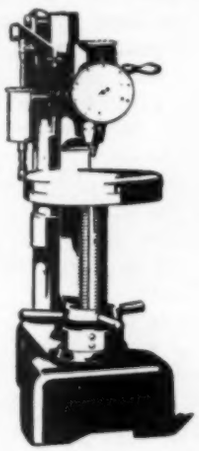
Although the time of load application can be varied at will, by adjustment of the dashpot, ten seconds is usual for ordinary work. In experimental tests a considerably longer period commonly is allowed. The microscope, by means of which the width of the impression is measured, operates on unique principles. Knife edges are set to the diagonals when the measurement is taken by reference to an indicator at the top of the ocular. The actual hardness figure then is found by reference to a chart.

IN the writer's experience, the Pyramid tester appears to be the one indentation machine which can be used with confidence on very thin sheet. The writer has carried out tests on soft brasses (that is, soft for the thickness considered) only 0.008 in. thick. Harder steels as thin as 0.004 in. may be tested. A disadvantage sometimes attributed to the Pyramid machine is that it is more of a laboratory instrument than a shop tool. Actually this is more apparent than real, for the construction is robust and the operation simple if a reasonably good grade of operator is employed. Because the impressions are very much smaller than for the standard Brinell or Rockwell machines, surfaces for test have to be prepared more carefully. Although the Pyramid tester is definitely a machine of precision, it requires care in operation rather than any particular skill.

In principle, the Herbert machine is like the others already mentioned. Direct gravity loading is used and the weights are composite, so as to enable various scales to be employed. It is a substantial machine, but in the opinion of the writer, is better suited for the rougher classes of work. It cannot well be used for hard metals, and is not intended for this purpose.



In rebound hardness testing machines a steel weight is dropped from a fixed height onto the surface of the material under test and the height of the rebound is noted. This height is taken as a measure of the hardness of the material, and is dependent upon the relative "coefficient of restitution" of the two bodies in contact, the permanent and elastic indentation made, and upon surface and mounting conditions. The Scleroscope is the most popular machine embodying these principles, and is one of the most widely used testing machines. Plain and automatic-recording types are made. In the plain instrument the weight drops inside a calibrated glass tube. It is released from the top of the tube by a pneumatic device operated by a bulb, which also serves to return the hammer to the "ready" position. The height of the rebound is noted by the eye. With a little practice this reading becomes easy, although at first it is difficult.



Surfaces of materials tested must be quite flat and free from oil and all other foreign material which might introduce error. If cylinders have to be tested they must be flatted first, as even a curve of very large radius may cause oblique rebound, which reduces the height by side friction, and thus the hardness figure. It is sometimes stated loosely that rebound hardness is convertible into indentation hardness. This is not necessarily correct. If all the relevant data of a test were known, possibly a conversion would be possible. If the hardness is in a well-explored region of the scale, and the properties of the metal are well known, conversion may be safe.

Although the principle of the automatic-registering Scleroscope is the same as that of the non-automatic type, the weight of the hammer and its height of fall are different. Results between the two machines, however, are interchangeable.

For good work, the setting up of the machine requires care which is not always given. Although the construction and operation of the machine seem to indicate that it should be useful for very thin materials, such is not the case, in the experience of the writer. The reading is influenced to a very great extent by the anvil. To build up thicknesses to secure a reading is worse than useless. The scale of hardness is somewhat close and considerable differences, such as are revealed by indentation machines, are scarcely discernible by the rebound type.

The Scleroscope, widely used by manufacturers in England, is, in general, a useful tool, but its readings must not be accepted blindly. Something of a joke often is made of the fact that substances such as rubber give a hardness reading higher than that of hardened steels. This is, of course, quite aside the point; any instrument may give absurd results if used for a purpose other than that for which it was intended.

In principle, the Alpha Rebondimeter is similar to the Scleroscope, but it is not widely used in England. In this case, a ball of 10 mm. diameter falls through a height of 250 mm. Observations made concerning the Scleroscope apply largely to this machine, except, perhaps, that the ball is more likely to be thrown sideways by imperfections of surface or of placement.

Perhaps the inclusion of cupping test machines, which actually measure something related to the percentage

elongation of a metal, may be out of place here. It must be remembered, however, that, with thin metals for press work, it is ductility which counts, even though we speak of hardness. When we say that sheet metal is soft, we imply that it is capable of being drawn deeply; we are not thinking of indentation.

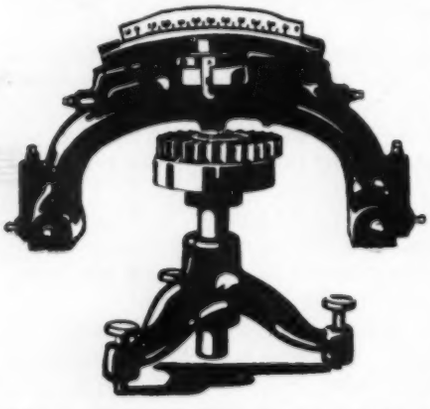
In the Erichsen machine the metal to be tested is clamped between a die and a ring-shaped holder, and a round-nosed piece is forced against the sheet by a screw until bursting takes place. When a fracture occurs it is observed in a mirror.

The Erichsen machine is a valuable adjunct to the factory in which much press work is done, but few seem to understand how this machine should be used. The only thing which is noted is the depth of draw, which, though valuable in itself, tells only one-half the story. Actually, there are three sources of information ready for our observation: (1) the depth of cup, (2) the dome macrostructure, and (3) the type of the burst.

Without attempting to discuss types of fracture and their meanings, it may be said that experienced men, after observing the fracture, can predict with remarkable veracity the probable happenings when the material is subjected to forming or drawing. A hand lens is useful for observation and is made still more useful if specimens are kept of different batches of metal and are labelled according to their press-shop performance. Good-drawing sheets usually give a high Erichsen reading and show an absence of a fibrous macrostructure and a smooth dome.

There are limitations to the test, partly because no indication of the force required to cause the draw is obtained. Two metals may have identical Erichsen values and yet act quite differently in the press, especially as regards speed of operation. One sample may be considerably tougher than another and will require that the press be run more slowly.

Again, an unskilled user of the Erichsen machine is likely to obtain different drawing depth than an experienced user will obtain, but truthful comparisons can be made between sheets of the same metal of approximately the same thickness. Drawing depth varies according to the sheet thickness. The average working range of the machine is between 0.004 and 0.120 in., but even within this range there is considerable variation. One safe method is to use sheet metal from one reliable manufacturer and take tests on each piece which comes in. Eventually then fair average values for the different grades of different thicknesses will be established.



The Erichsen-Olsen machine is similar to the Erichsen, except that both the drawing depth and the force required to effect fracture are measured. The maximum pressure which can be exerted with the standard machine is 12,000 pounds. In operation the machine differs from the standard Erichsen. The metal first is cupped to a definite depth but one considerably below that required to cause fracture. Both the depth of draw and the force required are noted. The test then is continued until fracture occurs but usually the final pressure is not recorded. Curves then are plotted between the pressure to cause a unit distance of draw and the depth of draw.

THERE is no doubt that the Erichsen-Olsen machine is extremely valuable as an indication of the probable press-shop performance of sheet metal. In it the human element is less evident than in the simpler original hand-operated machine. It is necessary, however, that testing be not done casually, but as a routine procedure.

A hardness tester known as the Herbert Pendulum gives results closely associated with the basic properties of a metal. It is a compound pendulum having an effective length of $\frac{1}{10}$ meter and its weight of 4 kg. rests upon a 1-mm. ball or ball-shaped diamond. The periodicity of the Pendulum is proportional to the hardness of the metal as measured by indentation machines, hence the hardness is proportional to the number of seconds required for ten swings of the Pendulum. The results this machine gives are reliable and are readily convertible into Brinell figures. The swinging, which is timed by a stop watch, simply takes the place of the dial indicator of the Rockwell and the microscope of the standard Brinell machines. When the width of metal is sufficient to foul the Pendulum, this machine cannot be used. Although the results it gives are convertible into Brinell readings, the formulas required for different metals are not always available. On soft steel, the Brinell hardness equals 0.36 times the square of the time-hardness; for soft brass, the Brinell hardness equals 0.29 times the square of the time-hardness.

One of the great advantages of the Pendulum is that it is capable of measuring the potentialities of a metal for work hardening. This is extremely important in press work, for excessive cold-working causes most failures.

For tricky press work it is necessary to know how much the metal will stand before it fractures. The more exactly this figure is known, the more work are we able to allot for a single press operation. More annealing than is necessary is wasteful, and sometimes the very nature of the finished piece demands that the metal shall be in a hard state when it comes from the last press. To ensure such results the metal should be worked to its maximum capacity, but if this capacity is exceeded failure results.

To measure work-hardening capacity by means of the Pendulum the usual time-hardness is taken and then the instrument is allowed to swing through its maximum amplitude. This causes hardening of the metal under the steel bar or diamond point. Then another time-hardness figure is obtained and this procedure is repeated until a maximum is reached. If time-hardness readings on stock for press-work are taken, the information accumulated can be used in future to prevent breakages.

Not so very long ago the "Cloudburst" tester was introduced. In it the surface of the sample to be tested is bombarded by small steel balls at high velocity. Any soft spots show up immediately. The actual hardness of the metal can be determined by reducing the number of impacts so that the ball impressions do not overlap and then measuring the diameters of the impressions with a special magnifying device. Results are said to be convertible, as might be expected, into the Brinell scale.

For ordinary factories the machine has distinct limitations, but where uniform hardening is vital it is of value, for it shows up soft spots without damaging the surface.

# Multiple-Spindle Gearing

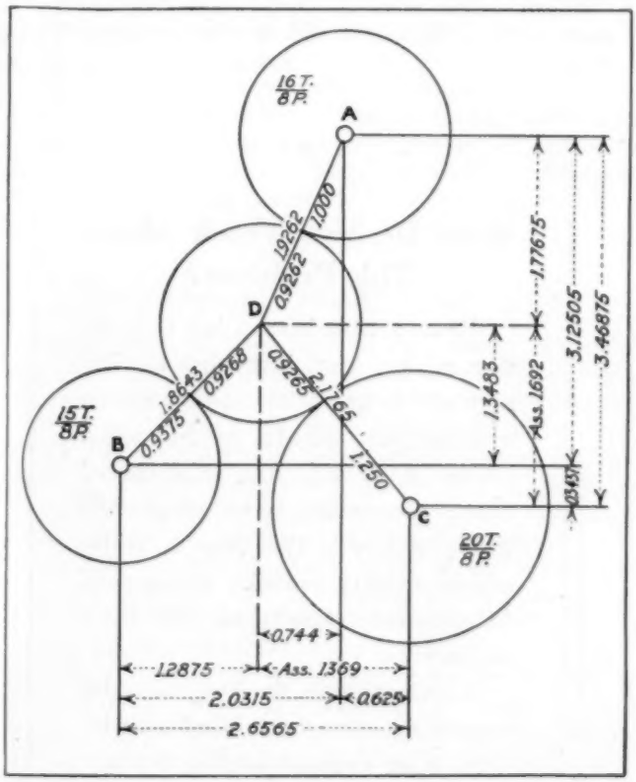
**W. N. Delenk**

*Special Machine and Tool Designer,*
*The National Acme Company, Windsor Plant*

A GEARING set-up similar to that shown diagrammatically in the illustration is always to be found in multiple-spindle machines where the gear-driven spindles have fixed centers and locations, and revolve in the same direction. The centers of the gears *A*, *B*, and *C* indicate the locations of three holes to be drilled, reamed, or tapped in a work-piece. The horizontal and vertical distances between the centers of the gears cannot be changed. Also, the relative sizes of the gears cannot be changed on account of the different r.p.m. required for the spindles.

The gears *A*, *B*, and *C* have 16, 15, and 20 teeth, respectively, and all are of 8 diametral pitch. The problem was to find the dimension and the location of an intermediate gear, represented by *D*, that would mesh the other three gears, so their rotation would all be in the same direction. The following method, used in solving the problem, avoids the use of higher mathematics.

It was considered advisable to use a scale divided into hundreths of an inch, and to lay out the gears on a scale of 10 to 1. By this means thousandths of an inch were easily scaled. The horizontal and vertical distances between gears *C* and *D* were then determined graphically as 1.369 and 1.692 in. respectively. Extracting the square root of the sums of the squares of the two scaled dimensions, the value 2.1765 in. was obtained for the center distance of the gears *C* and *D*. Deducting from this value, one-half of the pitch diameter of gear *C* (1.250 in.), leaves 0.9265 in. as one-half of the pitch diameter of gear *D*.




The next step was to prove the correctness of this dimension. Deducting the assumed dimension 1.692 in. from the vertical distance between gears *A* and *C* (3.46875 in.), leaves 1.77675 in. as the vertical distance between the centers of gears *A* and *D*. Deducting the horizontal distance between gears *A* and *C* (0.625 in.) from the assumed dimension 1.369 in., leaves 0.744 in. as the horizontal distance between the centers of gears *A* and *D*. Extracting the square root of the sum of the squares of 1.77675 and 0.744 in., the vertical and horizontal distances, respectively, between the centers of gears *A* and *D*, the value 1.9262 in. is obtained for the center distance of these two gears. Deducting from 1.9262 in., one-half of the pitch diameter of gear *A* (1.000 in. leaves 0.9262 in. as one-half of the pitch diameter of the intermediate gear *D*.

Having assumed the location of gear *D* in relation to gear *C*, and proved it in relation to gear *A*, the next step is to prove it in relation to gear *B*. Deducting the assumed distance 1.369 in. from the horizontal distance between the gears *B* and *C* (2.6565 in.) leaves 1.2875 in. as the horizontal distance between the centers of gears *B* and *D*. Deducting the vertical distance between the centers of gears *B* and *C* (0.3437 in.) from the assumed distance 1.692 in., leaves 1.3483 in. as the vertical distance between the centers of gears *B* and *D*. Extracting the square root of the sum of the squares of 1.2875 and 1.3483 in., gives 1.8643 in. for the center distance of gears *B* and *D*. Deducting from this value, one-half of the pitch diameter of gear *B* (0.9375 in.), leaves 0.9268 in. as one-half of the pitch diameter of the intermediate gear *D*.

The greatest variation in the three values found for one-half of the pitch diameter of the intermediate gear is 0.0006 in., which, of course, can be eliminated by closer figuring and by changing one or both of the assumed dimensions. However, in most cases of gearing the error is negligible.

Between gears of the size used in this example, a clearance of 0.001 in. should be allowed. Taking this into consideration, the pitch diameter of the intermediate gear would be 1.850 in. Since the pitch diameter of an 8-pitch, 15-tooth gear is 1.875 in., a blank for such a gear could be used by reducing the pitch diameter 0.025 in. and cutting the tooth spaces to the standard depth. This difference in the pitch diameter is within the allowable limit, because gears of this size can be made as much as 0.030 in. undersize.

# EXECUTIVE FORUM

## Ex Rights

HENRY K. MOORE, president of the Eastside Machine Company, did not know whether to feel relieved or not. He knew he was losing a good man in Charles Bloodgood, his production manager, who was leaving to take a position in a competing firm. On the other hand, high plant overhead had been a cause of concern, a condition which would be somewhat relieved by this voluntary reduction of force. Bloodgood's subordinates could undoubtedly carry on his well-founded methods, especially when business was slow. At any rate, Moore resolved to accept the move in good grace and to give his erstwhile junior executive a friendly send-off. With this in mind, he walked down to Bloodgood's office.

"Getting all packed up, I see," said Moore surveying the empty drawers and crowded desk top.

"Yes, Mr. Moore," said Bloodgood, "and now that it comes to making the break, I'm mighty sorry to leave this plant. Things have been real congenial here."

Moore looked more closely at the pile of papers on the desk. "Aren't those our routing forms?" he asked.

"Why yes," said Bloodgood. "I am taking one of each of the forms I designed while here—a job ticket, a time card, a stock record slip, a receiving form, a requisition blank, and the rest. No objection, is there?"

"There certainly is," said Moore. "These forms are company property, and I don't see why I should release them for use by a competitor. I'm surprised you'd consider taking them, at least without specific permission."

"Since you put it that way," said Bloodgood, "I'll certainly leave them behind. But I don't admit that taking them would be in any way unethical. A man's reward from a corporation comes in two ways—in his salary and in the experience he accumulates. His training and experience comprise his stock in trade. These forms are of little value in themselves, but they represent methods I've found best to fill certain functions. In one sense they belong to the company, but in another, they are very much mine."

"While you were here," said Moore, "the company paid for your ideas and their execution. A man's effort when in the employ of a concern belongs solely to his employer. An outside organization has no claim on the results of this work."

"I believe you're a little extreme, Mr. Moore," said Bloodgood. "If a friendly concern, even a competitor asked to inspect our routing system, you'd probably grant the request. But an ex-employee is regarded in a different light. Many employers feel, sometimes subconsciously, that a resignation from their organization is somewhat akin to disloyalty."

"Not with me," said Moore. "I have a high regard for you personally and wish you luck in your new position. But I feel it my duty to protect my company's interests and to retain for it exclusive use of any system it has paid to develop."

"I would not attempt to use the methods I devised here in another plant," said Bloodgood. "Every concern needs a system to fit its individual requirements. Of course, my experience here will be of value. The forms would simply serve as memoranda of certain details."

"Well, I'm afraid you'll have to forego them this time," said Moore.

"Perhaps it's better that way," said Bloodgood. "A man usually thinks more clearly when he starts with a clean slate."

■

### What Do You Think About This Problem?

**When a man breaks his connection with a firm, just what are his rights? Is he entitled to take with him tangible results of his work which will aid him elsewhere? Some companies have adopted a liberal policy in this respect, while others closely restrict the use of information developed by their employees.**

**Which course do you consider sounder? *American Machinist* invites your opinion on this topic.**

# . . . Discussion
## of Executive Problems

■

### How Much Incentive?

From experience we have found that the 50-50 plan is the most practical, as well as the fairest percentage to pay the operator for increased effort. In the first place, the operator receives, under our incentive plan, about 33⅓ per cent more money as a base rate for piecework than he would get on regular day work, which alone is an added incentive.

After taking careful time studies, the standard of production is set up. We use 100 per cent as the standard which an operator should attain and hold without endangering his health or person. All standards are guaranteed not to be changed, unless of course, there is some radical change in the article being fabricated or in the equipment used. This gives the operator confidence and assurance that his increased efforts will not penalize him by having his earnings cut. As an added incentive to increase his earnings, we pay the operator 50 per cent of all production over the 100 per cent standard. This virtually amounts to time and half for all work done after the operator reaches the standard. We have found that this bonus paid by separate pay checks looks very good to the employee, who feels that increased effort on his part is being amply rewarded.

This method of incentive wage payment is particularly adaptable to jobbing shops. It is very easily computed both by the cost department and by the employees.

—A. R. JONES, *Time Study Engineer, Transue and Williams Steel Forging Corporation.*

### Who Should Do the Estimating?

In compiling an estimate, four main factors are prominent: actual labor costs, material costs, establishment charges, and profits. The importance of these factors vary with the job. The work may be of such a class that the cost of materials far outweighs that of the labor necessary to transform them into the finished article, or the opposite may be true. Generally, however, the most vital factor, and the one most difficult to obtain, is the actual labor cost, and in estimating it, the utmost care must be exercised. As it is useful in most concerns to base the establishment charges on the labor cost, the careful calculation of this factor is still more necessary.

In most modern factories, there is some system of payment by results, either bonus or piecework, and to obtain a basis for any such system all work has to be planned, processed, and operating times allocated, before the work is placed in the shops. This is done by experts, who are perfectly conversant with the plant and its personnel and whose duty, in the event of the estimate being accepted and the work placed, will be to carry out these necessary planning operations. This department, therefore, is the ideal place for the compilation of an estimate, as by thus doing, a duplication of functions is avoided.

In addition to this obvious advantage, there is another which is perhaps not so apparent; that is the beneficial effect of allowing the department, responsible for the estimate, to share in the responsibility of getting the work through the shops, as no pains will be spared in carrying the work to justify the estimate given. If the planning department is supplied with the necessary percentage of profit by the management, it would appear to be the best department to accommodate the provision of estimates in a factory, the size of which does justify the existence of a large department devoted solely to this work.

—ALBERT WILLIAMS, *Chief Estimator and Ratefixer, Bristol Motor Construction Works, Bristol, England.*

### Square Deal or New Deal?

The management is largely to blame if misunderstandings arise when a change of executive personnel is made. The president or other high official should call in the general foreman and explain just what is contemplated and why they are making the change. He should try to create a frame of mind which will help the new man. The chances are that the general foreman would then want to co-operate. The new manager should give him to understand that he would be taken care of in return for his loyalty.

If a man won't co-operate after a heart to heart talk, the only course for the management is to let him out. The manager must then find out how many more men are going to buck him and either get them to work with him or drop them. Half-hearted measures in dealing with such cases are not conducive to harmony.

—WILLIAM C. BETZ, *Master Mechanic, Fafnir Bearing Company.*

### Square Deal or New Deal?

I was assistant engineer in planning and executing new improvements at the shops and other properties of my company and was making myself quite useful to my immediate superior, the head of the department. Some outside interests acquired sufficient stock in our company to be able to dictate largely as to the policies and personnel. Pretty soon, among other changes came a list to each department head of names to be dropped from the pay-roll. No reasons were given. It wasn't because of hard times, and there was no need to cut expenses to get along. My name, and those of one or two other assistant engineers, were on the list. My boss told me about it and said in effect he had determined to find a way to keep me.

The company was one of the old-established ones, where there was a pride in being in the company's employ and a willingness to pull together. Some of the men, whose fathers and uncles had spent most of their lives with the same company, were satisfied to stay for life, even if possibly they might make 50 or 100 per cent

higher pay elsewhere. There was no thought of the modern intimidation system, no flashing of concealed badges, or bullying men with constant fear of discharge. Such men are not easily led into strikes. When a company has the good fortune to have conditions like that in its shops, it is a mighty serious thing to apply the axe to the roots of the tree of confidence, that has taken decades to build up. Newcomers should think a whole lot before shattering such a condition in an existing organization. —H. J. KENNEDY, M. E.

## Jigs By Whom?

There seems to be very little doubt that the most satisfactory way with jig design is for the designer and production engineer to co-operate. While the actual design of the jigs and tools may be left to the designer, both he and the production engineer should study the best and cheapest way of producing the article with the plant available.

Very often, especially in a small shop, it is not always best to leave the jigging to the designer alone. The production man is in the best position to suggest the series of operations to be followed. There is no use crowding work on a few machines while others are standing more or less idle. It is far better to keep the whole plant working evenly. This is very likely to happen if jigs are made without consulting the production man.

On the other hand, jigs must be designed to suit the particular type of work for which they are intended, and the size, weight, and operation of them should be left entirely to the designer, who should know just where strength and lightness are required. It is up to him to make them easy to handle and "fool-proof."

—J. W. HESKETH, *Coventry, England.*

## Success or Successor?

The general manager of a medium-sized firm realized the capabilities of a certain youngster and made him his unofficial right-hand man. After about three years, there was not the slightest doubt that the youngster had acquired sufficient knowledge of the plant's workings to be entrusted with its management. Hard times came along, and the original general manager was dropped. The erstwhile youngster got his job.

The new manager also had a right-hand man, quite efficient, but not of the type that will ever qualify to control. When a new general manager is required, he will have to be imported.

There are usually plenty of men outside a firm who are qualified to take one's position should the occasion arise. Therefore, I contend that it is unwise as far as the individual is concerned to have a man of this type actually on the job. —HAROLD THOMAS, *Birmingham, England.*

## Inspection or Discretion?

I do not think an inspector should pass material which is not according to specifications. Even though it may seem to him that the material is quite suitable for the purpose intended, it is not his function to decide. He should promptly call the designers' attention to the situation, and they can very quickly change or alter specifications to suit. The instance outlined illustrates how necessary it is for thorough understanding and close co-operation between the inspection and designing departments.

If the situation is such that the parts cannot be held back without jeopardizing production or tending to increase costs and the inspector feels certain that the variation from standard does not lessen the real utility of the parts, he might be justified in letting them go through. But he should notify the designers of the action taken, pointing out that the parts have been allowed to go on account of the exigencies of the situation and their obvious suitability for use.

If, after reviewing the case, the designers feel that the inspector was right he should be so informed and the specifications changed at once. If not, then it would be well to give the inspector the reasons for the limits being closer than would seem necessary to him.

—H. GREENHALF, *Walkerville, Ont., Canada.*

## Square Deal or New Deal?

When a new executive takes charge and is given a free hand to reorganize the factory personnel, he ought first to familiarize himself with the local background. He knows approximately the results he has promised to accomplish in a specified time. Before he can make the moves for transition from the old to the new, he must study his foremen and the organization. Two weeks are not sufficient to form even a partly correct opinion of how various men will fit in.

Having been in similar positions on seven occasions, I have found that we could accomplish most by using our firing authority very sparingly. It proved very valuable to have a frank but friendly talk with each foreman who might not be co-operating, telling him our reactions to his apparent attitude and letting him know that we did have it in for him but wanted him to help us make good. This resulted in creating a spirit of confidence and respect and saved about 90 per cent of the foremen and superintendents involved.

—E. E. GAGNON, *Mechanical Superintendent, Raybestos-Manhattan Company.*

## The Other Fellow's Toes

To take on a new line of work when times are dull would not be a wise thing to do unless the new article was a clear-cut proposition, and the firm's machines and tools were suitable. It is a hopeless task at any time to market a machine that there is no real need for, in which case, it would be better to get a new line of work. But if the machine sells in good times, and not at all when business in general is slack, I would investigate the methods and tools used in the shop to see if they were up to date. If not, I would take steps to remedy this evil of all shops that do not follow up the developments of their time. I would try advertising, which helps more than most small-shop managers realize.

It is not a good policy to take on many different lines of work even in good times, unless the company in question has large resources. Today everybody must specialize on a certain class of work, if he is going to live at all in competition with other firms.

—A. E. FRISTEDT, *Stockholm, Sweden.*

**Fig. 1—Change wrought by a modern lighting system, as shown by a single-exposure photograph of the old and new condition**

# UP-TO-DATE LIGHTING

C. E. WEITZ
*Engineering Department, General Electric Company*

DURING the last five years remarkable improvements in factory lighting conditions have been effected. Although no amazing developments in equipment or in the technique of lighting have appeared, this period has witnessed more progress in bringing about good factory lighting than has any previous decade. An eloquent testimony concerning lighting progress is given in the single-exposure photograph reproduced in Fig. 1, in which the change wrought by modern lighting as compared to the obsolete system is self-evident.

Artificial light should not be merely something to enable continuation of work when darkness makes things too dim to see clearly; it should be something to help the workman do his job better, more safely, and more comfortably than he ever has done it before. Much has been said about the relation of good illumination to safety, to production, and to the health and welfare of industrial workers, and this one picture seems to proclaim this entire doctrine of modern lighting. Gloomy and dingy shops are being transformed into bright and cheerful workplaces. Glare and foreboding shadows give way to soft, well-diffused, and uniform lighting, and the change brings rich rewards in eyesight conservation and in well-being that the workers of our country have a right to expect. Can any factory manager view this picture and fail to recognize lighting, not alone as a productive tool, but also as a tangible asset and responsibility of management?

That factory managers are widely accepting this modern viewpoint on lighting is attested by hundreds of instances of relighting. From all over the country and from all sorts of industries, the indications are that modernization of lighting in workshops is going steadily ahead. There can be no doubt about the enthusiasm of both management and workers, once they have had the experience of working under up-to-date lighting conditions.

A noteworthy case is that of the J. H. Snell & Sons foundry and machine shop, Hamburg, Pa. This shop is 37 ft. wide by 200 ft. long, and formerly was lighted by six 300-watt units providing less than 1½ foot-candles of general lighting. Extension cords were required by the workmen at each machine. The new system consists of 43 500-watt units, producing an average of over 20 foot-candles. The wattage was increased from 1,800 to 21,500—more than ten times—and the level of illumination increased fifteen-fold over the old type of lighting. Although this job presents no unusual features from the standpoint of the lighting installation design, it is significant that owners find it well worth while to increase greatly the expenditure for electrical energy to secure better working conditions. So pleased was the owner in this case that he is relighting two other plants in the same manner.

The attitude of the workmen is reflected in the following incident: The new lighting was first "turned on" unannounced. At the time two of the workmen happened to be arguing over the possession of an extension light. When the new system was switched on, and one of these men realized what had taken place, he threw the lamp and cord to the other at the same time saying, "Here, take the damn thing; I don't need it now."

One of the fundamental requirements of good lighting is an orderly system of overhead units so spaced as to ensure practically uniform illumination over the entire room, and provided with lamps of sufficient wattage to

assure a high level of illumination throughout the working area. A few years ago, illuminating engineers considered 10 foot-candles of general illumination an acceptable standard, but today industrial plants are setting much higher standards. Most new installations are designed for at least 15 foot-candles and installations of 20 to 30 foot-candles are becoming quite common. High standards of general lighting of this order usually obviate local lighting on individual machines; most certainly they spell the doom of drop cord extensions and their inefficiency, along with attendant nuisances.

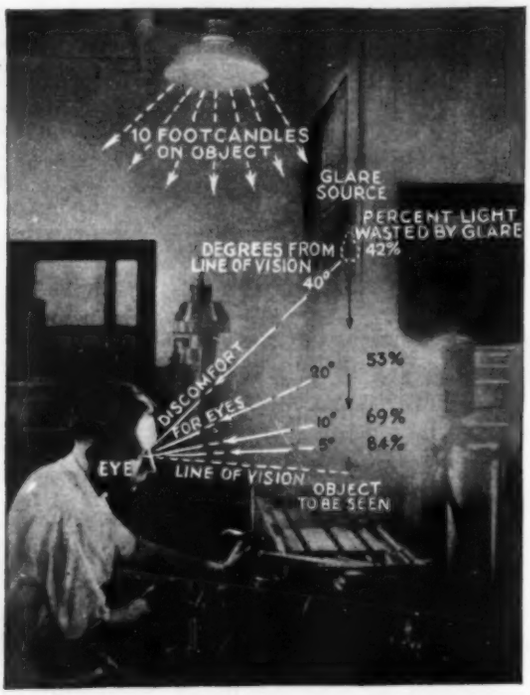



**Fig. 2—Glare is really an expensive commodity. Data given in a paper by Dr. M. Luckiesh and Frank Moss shows that a glaring light source within the field of view may reduce the worker's ability to see as much as 84 per cent**

Old ideas of the "economy" of 25- or 40-watt lamps at the end of drop cords for each worker are passing. Such makeshifts are found to be inefficient and, when all facts are considered, actually wasteful, not alone of the worker's time and energy, but also of his most precious possession, eyesight. It has been demonstrated that, where glaring light sources are within the normal range of vision, the reduced ability to see is equivalent to an actual waste of electrical energy, the amount depending upon the position of the source and the severity of the glare. As shown in Fig. 2, if a glaring light is in the field of vision, the equivalent waste of energy may be from 40 to 85 per cent, depending upon the prominence of the light. This measurable waste is purely that of reduced seeing ability, and is in addition to the discomfort and confusion of the worker. Even when a local light is shielded from the eyes of the user, it is quite likely to be so positioned as to shine into the eyes of other workmen and so prevent them from seeing well. A good system of overhead lighting with the units well up to the ceiling minimizes glare, unpleasant contrasts, and harsh shadows.

Even though an intensity of 25 or 50 foot-candles be advocated, it is modest indeed as compared to the 1,000 to 10,000 foot-candles out-of-doors in daylight. Recent scientific tests indicate that there is a gain in seeing ability even after the illumination is increased far beyond the most impressive general lighting standards that we have set so far. For that reason there still remains the need for supplementing general lighting throughout the room with additional local lighting on benches or machines where the visual task is particularly severe.

Because of the many shortcomings and disadvantages of light sources close to the work, the present tendency, when supplemental light is needed, is to throw this light onto the work from projector units located at the ceiling or on columns where they are out of the way, and where they can be permanently positioned to avoid glare and to direct the light to the best advantage. In this way 100 or more foot-candles can be provided where necessary, without introducing severe contrasts and without undue expense. Fig. 3 gives an example of such supplementary lighting.

Industrial lighting reflectors for the general overhead lighting are standard products. These reflectors, termed RLM and Glassteel diffusers, are known to be satisfactory equipment, and their performance in service can be predicted accurately. The use of 300- and 500-watt units spaced 10 to 12 ft. apart is representative of the better type of installation today.

In craneways or high bays, where the lighting units are mounted more than 18 to 20 ft. above the floor, more concentrated distribution of light is necessary for greatest efficiency. Then so-called "high-bay" units are recommended, for they direct the light more predominantly onto the work plane. Fig. 4 shows an installation of high intensity in craneways using high-bay units. In general, the wider spacing permitted for the higher mounting dictates the use of 1,000- or 1,500-watt lamps, with spacings of the order of 20 ft. Where the spacing

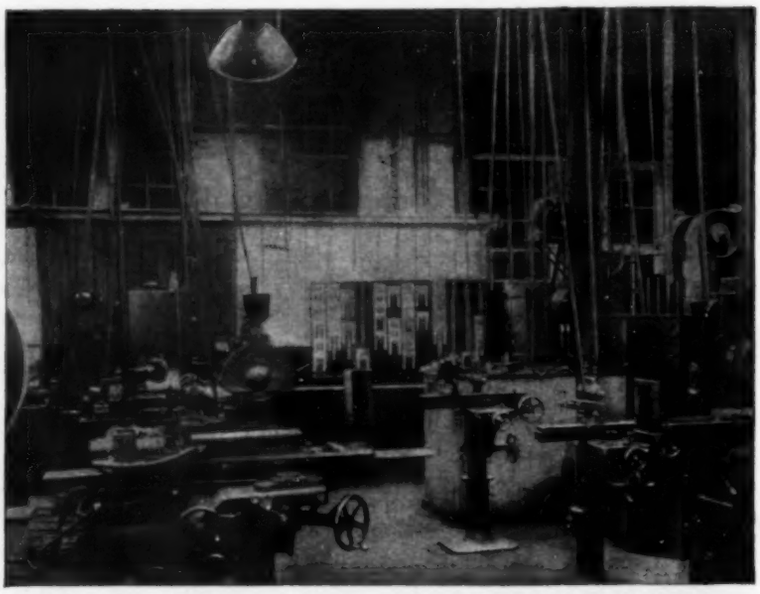


**Fig. 3—A projector mounted near the ceiling is used to supplement the system of general lighting where a higher intensity is required in certain limited areas**

is much greater than 20 or 25 ft. shadows are likely to be pronounced and the requirement as regards the lamp wattage is beyond the range of available lamp sizes, that is, if a fair standard of illumination is to be provided.

Statistics on lamp purchases bear out the assertion concerning the more general adoption of higher wattages and increased intensity of illumination. During the past five years the volume of lamp business as a whole has increased 32 per cent; but in this same period the number of 300-watt lamps bought increased 44 per cent, 500-watt 53 per cent, 750-watt 113 per cent, and 1,000-watt 62 per cent. Not all of the higher-wattage lamps have gone into industrial sockets, but industry is one of the chief users of large lamps for general lighting service.

**Fig. 4—Craneway section of the National Automatic Tool Co. plant at Richmond, Ind., showing the effect produced by using 1,500-watt lamps in "high-bay" aluminum reflectors spaced on 20 foot centers**

One newly-installed lighting system in a foundry which the writer visited recently originally gave an intensity of only 3 to 4 foot-candles. Several 500-watt units were added later where the castings went through a cleaning operation and were stacked up ready for the machine work. After these additional units were put in, the night shift men in this part of the shop finished work an hour earlier than before. Here the addition of an extra 1,000 watts of lighting, which cost 25 or 30 cents a night, saved one hour's labor of a half-dozen men. If only a fraction of this benefit had been carried to all of the employees throughout the entire room, the increased cost of light would have effected a noteworthy net saving. As installed, the system as a whole was really extravagant, for it slowed down the whole shop.

CONDITIONS like this would be less unfortunate if sufficient illumination could be had merely by putting in larger lamps. In this case, however, the units were spaced 20 x 40 ft. apart, using 300-watt lamps, whereas good modern jobs of the same character, with units mounted 25 ft. or more above the floor, on 20 ft. centers, employ 1,000- to 1,500-watt lamps. The first fundamental fault of this installation was too great a spacing between units to give proper distribution of light. When outlets are once installed any additions or changes represent alteration expense which would be saved if a proper layout were made initially.

A second fault of the system in question, and one that is most seriously hampering lighting progress in many other cases, was that the wiring was inadequate to allow the substitution of larger lamps. In old buildings it is to be expected that much of the wiring will be obsolete and inadequate, but no new installations should be obsolete when completed.

Some plants that put in a fair system several years ago have been increasing artificial light at intervals because they have found that, with each increase in lighting, the benefits have more than repaid the increased cost. One plant is reported to have increased its illumination four times during a period of three years.

In view of the superior standards of lighting now recognized and their attendant benefits, it is important that wiring systems be given more consideration as regards its future adequacy. The electrical industry is today giving more serious attention than ever in the past to the economics of wiring over and above the safety requirements of the National Electrical Code. Simple wiring rules have recently been devised, suggesting the size of wire, length of circuit, and wattage per circuit to insure sufficient capacity for future needs, and to guard against excessive voltage losses which mean inefficiency in the operation of incandescent lamps. A large proportion of lamps today are operated as much as five or ten volts below their most efficient voltage because of overloaded circuits.

A lamp operated at five volts below rated voltage delivers only 85 per cent of its normal light output; at ten volts under voltage only 72 per cent of normal. The wattage consumed does not decrease at this same rate, consequently the unit cost of light is actually seven per cent and eighteen per cent higher in these two cases than if the lamps were operated at their proper voltage. Moreover, the light obtained is of a yellow color. If inadequate wiring is responsible for a drop of ten volts in the line, excessive current is used in heating the wires. If the energy thus wasted went into the lamps, the wattage consumed in the lamps would increase five per cent but this increase would enable the lamps to deliver thirty-five per cent more light. Facts such as these should be given full consideration in appraising present or future installations.

New ideals of lighting are bringing new pleasures, new conveniences, and new environments to factory workers, and a wealth of evidence indicates that factory executives quite generally share the belief that this alone is well worth the cost of improved lighting arrangements. In addition, direct benefits in increased production often are realized.

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SEVERAL metal-working plants possessing portable arc-welding outfits use them occasionally for charging batteries for electric industrial trucks. Although the welding outfit is neither designed nor recommended for this sort of use, it has been found to operate very successfully if proper attention is paid to charging rates.

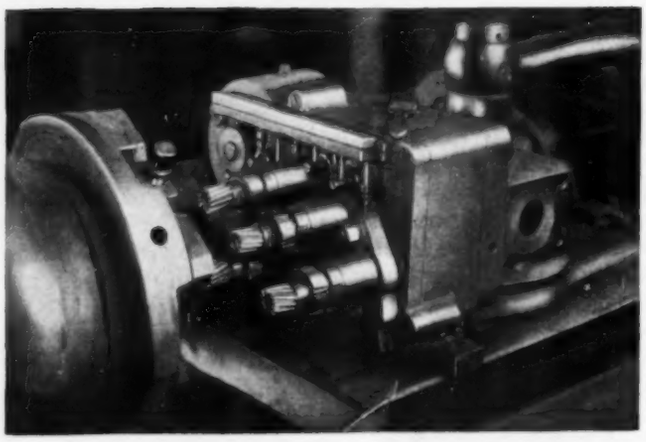
# SPECIAL ADAPTATIONS AND FIXTURES

**W. H. MALLIET**
*Supervisor of Design and Development, Royal Typewriter Company, Inc.*

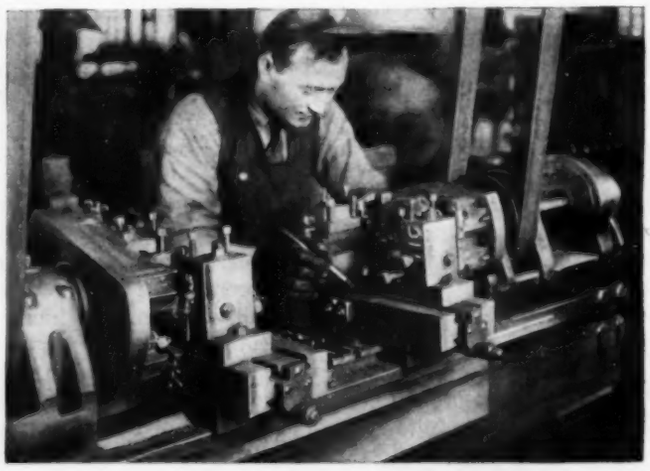
TYPEWRITERS click and clatter wherever Roman characters are used to express thought or record spoken words. To reach these places they travel by train and steamship, man-pack and camel, and they must be built to withstand the handling that may be expected or unexpected.

After their arrival at the most remote places they must operate as freely as they do in the city of their origin. And if they have been damaged during transit, or are damaged later, the replacements must fit as accurately as did the parts they replace.

A large percentage of the workers in a typewriter factory are employed in assembling, fitting, aligning, adjusting, and inspecting the different parts. All this work however must be done on individual parts, and sub-assemblies, and it must be done to gages and fixtures that make each unit or sub-assembly interchangeable with every other similar unit. Nor does this mean adjusting misaligned parts individually in the finished typewriter.



**Arrangement of a Potter & Johnston machine in which a multiple spindle milling fixture is carried on the turret slide**



**A reconstructed lathe that slots and broaches two segments on each of two heads**

The entire staff of such a plant co-operate in discovering and inventing cheaper and better methods of manufacturing, but always with accuracy as the first requirement. Standard machines are utilized as far as possible, but in many operations it is found that special machines or special adaptations of standard machines either serve the purpose better, or else they save time because of the number of parts that can be accommodated.

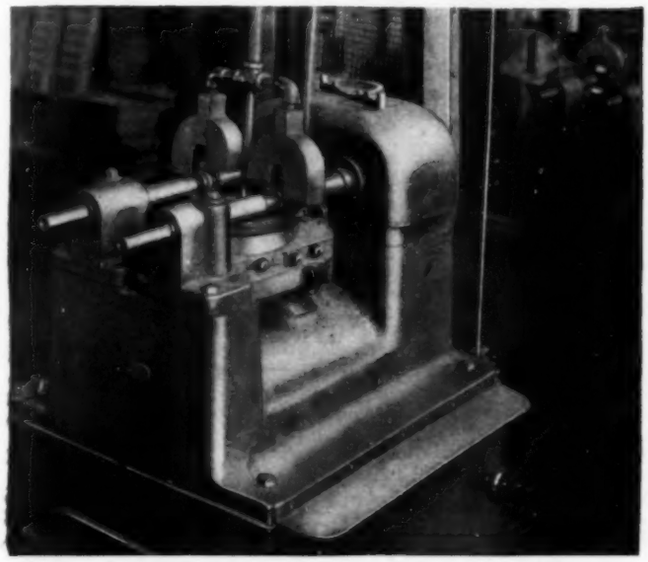
Of these parts the segment is the most important. It is in this part that the type-bars function, and the delicacy of workmanship required is on a par with that used on the most precise instruments.

The first departure from standard machines is the use of a redesigned Potter and Johnston semi-automatic chucking machine. This machine is fitted with a four spindle end milling fixture on the turret slide. The two lower cutters are adjustable for diameter, and all four can be moved in and out to compensate for grinding. Two segments are held at one chucking and the milling fixture advances for machining the inside and outside circumferences and the upper and lower faces of the segment simultaneously.

The action of the turret slide combined with the space between the two segments allows the cutters to advance to position before they begin to cut. This reverses the usual order in which the cutters are fixed: work advances to them.

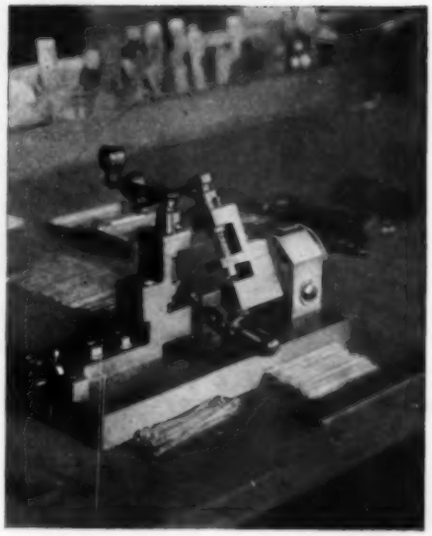
The subsequent operation, slotting and broaching the segment for the type-bar fulcrum wire, has been the subject of much thought on the part of our tool engineers. The result of this thought is the double-head machine shown in the illustration. Its function is to cut a 0.080 — 0.082-in. slot and then broach a circular groove at the bottom 0.0957 — 0.0967 in. in diameter.

The tolerance on the slot in relation to the face of the segment is 0.0005 inches



A full automatic machine for spacing and milling slots at different distances apart

Grinding the type-bars to fit individual slots in the segment



A different shaped link is required for each type-bar. These are bent in a hand operated fixture

This groove holds the wire on which the type-bars swing. Inasmuch as the circular broaching tool removes only 0.007 in. of material on each side of the slot, the operation can be done at a slow turning speed. Being done at the same operation, the slot and broach are in perfect alignment, and the slot supports the broach while it is cutting. The operation of this machine is semi-automatic, as the operator loads one head while the other is working. Each head holds two segments and has a capacity of 25 segments per hour.

Even with semi-automatic operation and fixed tool gages for depth, it is found advisable to check the depth and trueness of the slot. To do this, every other segment is checked on a fixture the registration of which is such as to give the relation of the center of the fulcrum wire to the type-bar banking ring. This banking ring is the surface that controls or limits the throw of the type-bar, so that it will make a uniform imprint.

Following their inspection the segments are set up in pairs in an automatic machine to have the slots cut for the type-bars.

Several machines are used for this purpose. Each has an elevating table and an indexing mechanism that spaces the slots at different distances. Starting at the outside, they are approximately 3/16 in. apart and $\frac{5}{8}$ in. deep, narrowing to $\frac{1}{8}$ in. apart at the center and gradually increasing to 3/16 in. again.

These machines are fully automatic, each having a capacity of six segments an hour. The operator simply places the segments, trips a lever, and when the cycle of indexing is finished, the machine stops automatically. The tolerance on these slots is 0.0006 in., and the saws cannot, therefore, be crowded.

The other operations on the segment are performed on standard machines in the usual manner, except that possibly more than ordinary accuracy is demanded.

Interchangeable manufacture does not depend upon the closeness of the tolerance of different parts, but on the allowance between two mating parts.

Notwithstanding that we hold the slot width to 0.0006 in., and the material from which the type-bars are made to 0.0005 in., we find it necessary to fit each individual type-bar to its slot. This sizing is done by passing the fulcrum end of the type-bar between two opposed cup wheels. The machines in which this is done are special and have micrometer adjustment for the wheel spacing. The bar is held in a cam vise mounted on a swivel arm.

**After the links are bent they are numbered on a revolving fixture**

**The carriage track is rolled under a hardened gear to form a rack for the carriage gears**

The arm passes the type-bar between the wheels, and the operator tries it in its individual slot.

Connected to each type-bar is a link, these links have a loop at each end, and each link is bent to a different angle or shape. It has been found that this double looping and bending can be done better by hand. Such parts can be made on a standard wire-bending machine, but the feed on such machines is not positive and it would be difficult if not impossible to get the center of the loops accurate to the degree required.

A girl can bend 6,000 parts in a day. As they are bent around center pins, the distances are accurate. An accompanying photograph shows a fixture with one head fixed and the other adjustable in two directions to accommodate the different offsets and angles.

In bending, the wire is placed in a nest plate contacting with the two center pins. A central clamp prevents the wire from moving in either direction, and the lips on the two pin shafts form a loop in each end when the pin levers are manipulated.

The numbering of the links takes place either before or after the loops, or hooks, are formed. Generally the long members are numbered before bending, and the short one afterward. The wires are placed in slots in the periphery of a wheel and rolled beneath a rigidly held number or series of numbers. When the wire strikes the figure it revolves under it and is indented with the character. A pick-off drops them into a storage box marked with the part and serial number, for conveyance to the stock room. Production on the bent link is 29,000 per day.

The carriage of a typewriter runs on a double track on ball bearings. These bearings are loose between the carriage and the tracks, and, in the course of time, they would normally all work to one end or the other and bind the carriage. To prevent this they are surmounted by a gear, and the teeth of the gear mesh in the rack-like indentations in the formed track.

The holes are perforated when the track blank is flat. Bending the blank 90 deg. along the line of holes elongates them. After bending they are placed in the machine shown above, and the elongated holes, or rather the lands between them, are spaced and rectified by a hardened master gear.

Pressure can be applied to the gear by the hand wheel shown above the fixture, the track is rolled back and forth by the lever hand wheel in front until it runs smoothly and easily.

Many other more or less special machines are necessary in the manufacture of typewriter parts, and most of them are entirely different from those used elsewhere.

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## Trends in Buying Stimulate Standardization—*Discussion*

W. R. NEEDHAM
*Stafford, England*

AS A COROLLARY to Mr. I. J. Fairchild's article, on page 873, Vol. 72, of *American Machinist*, it may be stated that the salesman, interested in a standard proposition, can often in turn interest the representative of the customer in standardized alternatives. Then buying which forms the stimulus to standardization is itself influenced by the skilful advocacy of those who know how to present a good thing in an inviting and convincing manner. The alert salesman seeks to carry his friendly warfare into the camp of the enemy, his friends.

More can be done by co-operation between manufacturer and customer than is commonly realized. A friendly discussion of certain ways for securing certain results can prove, in many instances, helpful to both parties. The manufacturer can show, for instance, how by offering a certain machine, the benefits and economies of standardization can be utilized to the advantage of both. The price will show appreciable saving to the purchaser. Generally, too, where such a course is possible, the article, machine, or equipment can be fully relied upon, having stood the test of time. The progressive manufacturer by a periodic overhaul of design and production methods, will be enabled to offer something which is as near the last word as economy and efficiency can possibly produce.

In Britain, for example, drawing office material manufacturers have suggested and welcomed the co-operation of the users of their products. By this means, it is felt that supply will suit demand in quality, quantity, and especially in service, to a degree that was not formerly possible.

# NEW BOOKS

WAGE-PAYMENT PLANS THAT REDUCE PRODUCTION COSTS.—*By Hugo Diemer, Director, Industrial Courses, La Salle Extension University. 272 pages, 5½ x 9 in. Published by McGraw-Hill Book Company, 370 Seventh Avenue, New York, N. Y.*

As indicated by its title, this volume is primarily devoted to the presentation of data on specific wage incentive methods employed by a number of industrial concerns. In the introductory chapter, the author calls attention to the growing use of wage plans, and outlines their basic principles. In this connection he furnishes some interesting statistics from past industrial surveys. Standard incentive systems are described in detail. These range from Taylor's task rate to recent group plans used in the automotive industries and include the author's own bonus and premium method.

Abstracts from articles by industrial executives, describing experience in their own concerns, form the case presentations. Among these are some of undue length, comprising not only a description of the method in use but also generalities on the subject which are quite amply covered by Col. Diemer in his opening chapters.

It is likely that these examples will be of value in the selection of a suitable incentive plan. The volume serves as a handy summary of present wage practice but presents no particularly new light on the subject.

TRADE ASSOCIATIONS—*By Joseph Henry Foth, Professor of Economics, University of Rochester. 338 pages 5¾x8⅜ in. Indexed. Published by the Ronald Press Company, 15 East 26th St., New York City. Price $4.50.*

One familiar with present-day commercial activity is likely to take the trade association and the service it performs somewhat for granted. This volume brings home in a forceful manner that these many-sided adjuncts of business were at one time non-existent; that their early struggle for recognition was extremely onerous; and that they passed through many phases some of which had a seamy side.

The author distinguishes between trade associations and other commercial and business bodies, such as chambers of commerce and general manufacturing associations that do not represent a specific field of trade. He traces their history from 1853, when the American Brass Association was organized, to the present day. In their early days, these associations were beset by extreme individualism on the part of their members and were looked upon with suspicion by governmental agencies. Their need was emphasized by periods of business depression and by the existence of many trade abuses. Their early proclivities toward price-fixing were the source of most of the apprehension with which they were regarded a few years ago.

In more recent years, and especially since the war, not only have the associations changed their methods and scope of activity but the attitude of the government and general public toward them has reversed. They are now recognized as a constructive and necessary side of modern business.

Dr. Foth enumerates and describes the contributions made to the country's commercial structure by trade associations. They are active in securing uniform and fair legislation for their constituents; they have defended the principle of self-government in business; they have promoted scientific industrial research and have fostered standardization and simplification; they have participated in market research and trade extension; they have rendered valuable service in the gathering of statistics and in the establishment of uniform cost methods. One of their outstanding services has been the war against unethical business practices.

Today trade associations are a powerful and growing influence. They work closely with such bodies as the Federal Trade Commission and the Better Business Bureau. Co-operation between the various trade associations is developing. It now remains for them to assume even greater responsibilities in the solution of the major problems of industry.

COST FINDING FOR ENGINEERS.—*By Charles Reitell, Professor of Accounting, and Clarence Van Sickle, Assistant Professor of Accounting, University of Pittsburgh. 518 pages, 5¾x9 in. Cloth-board covers. Indexed. Published by McGraw-Hill Book Company, 370 Seventh Ave., New York, N. Y. Price $5.00.*

This textbook, presented to introduce accounting to students of engineering, is complete and logically arranged. A series of brief questions appears after each chapter to use in the classroom or to aid the reader in analyzing the subject matter. At the close of the book, a number of concrete problems are grouped to correspond with chapter topics.

In addition to unfolding the mechanics of cost finding, the authors endeavor to impart a modern concept of their subject. They show that present-day accounting has progressed beyond its former functions of a historical record and a means of price setting. They show it as a dynamic tool for the engineer and the manufacturing executive in their efforts to achieve greater efficiency and eliminate waste.

The volume follows rather routine lines but avoids phases of accounting irrelevant to engineering problems. The practical presentation reflects the authors' industrial experience.

MACHINE SHOP UNIT—PART III. It contains processes 25 to 36 of the "Trade and Industrial Series" developed by the Wisconsin State Board of Vocational Education. These sheets are in loose-leaf form, bound in a paper folder, and embrace such basic operations as taper boring in the lathe, use of the follower rest, boring in the drilling press, cutter grinding, shaper work, and spur gear cutting. Information sheets on several of the processes are included. Convenient means are thus afforded for teaching apprentices and mechanics fundamental operations so that they can tackle any job by recognizing the various operations required and performing them in the most expeditious manner. The folder is published by the McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York, N. Y. Price $0.35 per copy, or $4.00 per dozen.

# The Foreman's Round Table

## THE FORTUNE TELLER

"SAY, Al, you remember that crazy idea I told you about when I came back from my vacation?"

"Which crazy idea? There were several."

"Never mind that. I mean the one where they established different social strata in the shop, and the blacksmiths were part of the brain department. Well, our personnel man must have heard something about it, because he came around to my office yesterday and wanted to know what I thought about giving a psychology test to new men."

"I think he was trying to find if you knew what they were. What did you tell him?"

"I told him, in the first place, that I thought he was fooish to do anything that would attract attention to his department, because the management was looking for ways to save money and would probably abolish his department as useless. You don't need a personnel department to lay off men."

"If you handed him that jolt in the first place, what in blazes did you wind up with?"

"Oh, I told him about a friend of mine named Joe. Joe had a dog and no children. He spent a lot of time in trying to teach the dog tricks, but without much success. He was commenting on this one night at a poker party and wondering why the dog was so dumb. The man he was talking to told him there was one thing necessary in teaching a dog tricks that possibly he had overlooked. Joe bit eagerly and asked what it was. 'Well,' the friend replied, 'when you undertake to teach a dog, the first essential is that you know more than the dog.' Imagine that personnel man conducting a test on a foreman."

"Watch your step, big boy. A psychological test is not an examination to find out what you know, but to fix the extent of your knowledge and your adaptability. Suppose you are hiring a lathe hand. He can bone up on all the questions you can ask him about his trade, but ask him what the effect of silicon is on cast iron and his answer will show whether he ever wondered what makes castings hard or not. If he didn't he isn't liable to make a first class lathe hand. The same with a foreman. They don't ask him about running a department, but about the immigration law or something like that."

"Yes, but what use is a foreman or superintendent, then? You can't convince me that a clerical man can pick out men for me better than I can do it myself."

"He can't, but he can supplement it. The questions he asks are common to all men, those you ask apply to specific knowledge. I once knew a superintendent that would let his assistant pick out a man, fix his rate, and hire him. Then the superintendent would appear to disagree, just to see how the applicant would react under an irritation. Crude and unjust, maybe, but effective. The only question is, and Williams will decide it, not the personnel man, what weight should be given psychological tests, and whether they should cover mechanical aptitude as well as mental alertness. The personnel man was probably giving you a test to see what class of rough necks he would send you."

"The son-of-a-gun! I wonder."

**Are reaction tests reliable as indicating the mental alertness and mechanical aptitude of an applicant? How far are they applicable, and should they affect the rate paid? Do such tests really help to cut down the number of square pegs in round holes?**

Suggested by H. S. Deeley,
Canadian Johns-Manville Company.

# ▸ ▸ ▸ Discussion of Former Topics

## From Another Angle

During the past twenty years I have seen many drawings, both good and bad. In the files of one large concern were drawings on brown paper with the original design shown in black ink, and each change in a different color ink. No erasing was done, the obsolete lines being crossed off by many short cross lines. Our friend Ed should see some of those drawings, and he would think a good print from a third angle drawing was simplicity itself.

Another firm I was with employed over a hundred draftsmen, and for many years went to the expense of shading every line and circle for clarity. Their work was large and many slight variations of a given part were necessary for each machine. To make separate drawings of each piece would have been prohibitive. The scheme used was to call the first one *A*, then *AA* for the opposite hand, *AB* like *A* except, *AC* like *AA* except, etc. Some of these drawings had eight or ten combinations, which made them difficult to read, but drawings are expensive to put out. Good shop men become accustomed to the practice followed in the drafting room and do not expect an intricate piece to look like a block of wood.

During the war, I saw at one of the arsenals a drawing of a sixteen-inch gun that was strictly a shop-man's drawing. The white prints received for factory use were often blurred and in some cases three or four had to be used to see what was wanted. Another trouble was that they were drawn to scale both ways, making all diameters very close together. The solution to all this was the making of an ink tracing, drawn to a scale as large as possible for diameter, with no scale maintained on length. The gun looked like a mortar, when in reality, it was a coast defense rifle. The shop men were strong for this drawing and felt that the engineering department at that arsenal was doing all it could to help them.

Drawings should not be cheapened to the extent of possible error, as a little more time on paper is much cheaper than making parts over or correcting them at assembly. —L. F. Swenson, *Industrial Engineer, Perkins Machine & Gear Co.*

## Boss, or Advisor?

Gus's conduct in reading a newspaper during working hours is typical of the way in which many old, and often privileged, hands view the arrival of a young assistant foreman. His lack of years, whatever his practical experience may be, is a disadvantage at the commencement, but if he has the necessary qualifications for his job he will find that eventually the older hands will give him as much respect and co-operation as the younger ones.

Occasionally cases are met with where an old employee resents the introduction of a new assistant, and while he is not actually insubordinate, he will fail to give that co-operation which a new foreman is entitled to expect from all employees under his control.

Gus appears to be one of these. He was no doubt doing what is called in the shops on this side, "Trying the weight of the new assistant," in other words, endeavoring to find out just how far he could go without being reprimanded.

It would be difficult to make out a good case for allowing men to read newspapers during working hours, even though they may contend that their machine was running and producing during the time.

With the present method of production there are few cases where it would be possible, and even in these cases no man can concentrate on a news sheet and a machine tool at one and the same time.

—Wm. L. Waterhouse, *Staffordshire, England.*

## Stealing T. C. Tools

The foreman has always known that every mechanic carries a number of pieces of tool steel in his tool box, for he usually carries them himself, or has carried them, and he cannot except to keep his men from doing the same thing. There are very few mechanics who do not reserve at least one drawer in their tool box for steel, and most certainly they do not buy it.

Suppose Bill Jones does carry a number of tungsten-carbide tools with him when he leaves the firm's employ. This cannot be considered a total loss, because Bill, no doubt, had a number of pieces of good steel when he started and has used most of them on the company's work. The man that takes Bill's place will most likely bring tools of equal value with him so that the company gets an even break. Allowing men to keep any kind of tools is a profitable investment.

—W. J. Owens, *Foreman, Newport Rolling Mill Company.*

## From Soup to Nuts

It is an interesting fact that many foremen resent being asked to attend company activities such as dinners, ball games, and dances. They object to going even though these things are gotten up for their benefit. The biggest reason is that the average foreman lives a closely circumscribed life. He travels in a small circle, and after a time his habits become so strongly formed that it is a real hardship to break into them.

I don't approve of company welfare activities that we are spanked into attending in order that the welfare director may point out to the owner how much we appreciate his bounty. On the other hand, the establishing and polishing of social contacts is as much an asset to a foreman as is the ability to read blue prints. More so. The ability to make and keep friends is worth more than a college education. Mediocre ability plus good social contacts and the ability to mix smoothly will carry a man further than phenomenal ability plus a harsh, forbidding manner.

Most of us know men, wizards at their jobs, whose advancement has stopped because of uncouth manners

that might have been ironed out early in life by proper social polishing. That "line" we envy in so many men—what is it but a fair ability to talk plus the self-confidence that social mixing has added?

—JAMES K. MATTER, *Supervisor, E. G. Budd Manufacturing Company.*

## Honest Graft

To book overtime while attending a foreman's meeting is not only morally wrong, but foolish. There is no pretence at work; why then should time be booked? It is quite indefensible, and to justify such practice would puzzle a solicitor. Moreover, it shows a bad start towards a position of trust, because it is indicative of the future. There is no justification even for bare time. Nothing is done and nothing needs to be paid for. It will cost considerable to pay for time at welfare, ambulance, and foreman's meetings. Firms cannot afford this, unless they are very wealthy. Neither must we think hard of the boss who has to stop these things. Though necessary, it is an unpleasant duty, and needs a strong-minded man.

—WILLIAM BRYCE, *Sheffield, England.*

## The Safety Court

A man's efficiency line varies throughout the day in direct proportion to his fatigue line. Most accidents happen at the lowest points in those lines. An intelligent application of the results obtained by a careful study of industrial fatigue will minimize those accidents supposedly due to carelessness. This preventative method will be better and fairer than the safety court, which after all merely metes out punishment for something past—the equivalent of locking the stable door after the horse is stolen. The charge of carelessness is a serious one to lay at any man's door, since it does not credit him with any responsibility for the safeguarding of his own person. The saving of his own skin is far more likely to act as a deterrent against any form of carelessness than the knowledge that his payroll will suffer if he allows half his thumb to be torn off.

—J. TRICKETT, *Lancashire, England.*

## Boss, or Advisor?

It would seem to be the best policy for the "kid" to learn something about the men under his charge before handing out orders of the nature described. Doubtless the boy was sincere and did not expect good old Gus to give him a sharp answer. I've known few bosses so detestable as the so-called young "squirt" who goes about giving orders at every opportunity.

It may also be that Gus was a little "touchy"; in fact, I am sure he was, judging from what I have known of machinists of his type. Men who spend their lives running one or two types of machine do not have a rosy outlook. They feel that, where their own work is concerned, there is no one more capable than themselves. And why not?

The "kid" should remember that he is only learning to be a boss, until such time as he knows his men.

—RALPH M. GAMBLE, *Jones & Lamson Machine Company.*

## Keep Out

Functional organization naturally demands that there should be a channel through which orders can flow from the top of the organization chart to the bottom-most rectangles. But management likewise subscribes to the fact that executives are charged with results, and that one of its prime functions is to break rules, when necessary, in order to get these results. To circumscribe departments with a lot of artificial fences and only one gateway, and then to insist that the entrance of ideas from above may only take place when the gatekeeper is present in person, is childish. Just as it is wrong for a superintendent deliberately to hold back an order until a foreman is absent, so it is wrong to insist that a superintendent must ignore an emergency and withhold action until a foreman's return. The superintendent should act at once, but he should make it a point to be the first to acquaint the foreman with the change and the reasons therefor.

—LEON J. LICHENSTEIN, *Naval Aircraft Factory.*

## No Parking

By no stretch of the imagination can be found a reason why the company should be responsible for furnishing parking places for employee's cars. In many plants every foot of ground is made useful and remunerative. A company situated like this would have to buy extra land in order to furnish even open air parking space. Of course, a free garage is out of the question, cost making it prohibitive, as the company is in business to make dividends and not to furnish unnecessary things free of charge.

Extra conveniences are worth something to everyone who can make use of them. Where the company goes to extra expense to supply parking places, the employees should not object to a nominal charge for the service.

—L. O. BROWN.

## Do Errors Cancel Each Other?

While I would not unqualifiedly subscribe to the theory that errors cancel each other, I do believe that too much emphasis on errors tends to reduce the apparent error costs while it increases unapparent costs out of all proportions.

Charging a man directly for spoiled work may be good practice if the error can be unqualifiedly traced to the individual, and provided there is likewise a system of rewarding the individual for every job he beats the estimate on. The inherent difficulty is that, in most cases, the bad deed is easy to evaluate and debit while the good deed is so hard to evaluate and credit that it would take an overhead organization of experts which would come close to economically wrecking the organization sponsoring it. In addition, all this supposes an industrial Utopia in which human nature would never succumb to the desire to beat the system.

Too much emphasis on assigning individual responsibilities for errors, even though there is no direct monetary penalty, leads to the development of a too complaisant post mortem attitude on the part of executives. The fixing of responsibility for errors becomes the major motivating force instead of that of avoiding errors.

—FRANK KAHN.

# BURS AND FILES
## And Aluminum Castings

**Fig. 1—Cleaning up between the fins of aircraft cylinder heads would be a tedious, expensive undertaking except for flexible-shaft machines and mill-cut burs**

FROM a metallurgical curiosity to an essential mechanical and industrial element, aluminum has blazed its way in forty years. So great has grown the demand for castings, forgings, and mill products that huge units like the Fairfield (Conn.) plant of the Aluminum Company of America have been dedicated to the now familiar metal and its many alloys.

Each day at Fairfield are poured thousands of castings from many of the thousands of patterns in storage. Each casting is under strict laboratory control. Like a young child, each must be cleaned and dressed. It is with the varied dressing operations, and particularly with mechanical filing, that this article is concerned.

Under normal conditions, a crew of say 48 men may be employed in a shift for the dressing operations. This force would be divided up as follows: six men on core knockout; ten men on chipping and filing heavy castings up to 5,000 lb. and medium work from 50 to 100 lb.; 18 men on light work up to 50 lb.; four grinders; three bandsaw operators; four sand-blast operators (2 helpers); three welders and a helper; and one polisher.

After core knockout, the castings are examined for physical and chemical characteristics by the laboratory, utilizing a number of test blanks cast with each piece. A large proportion of the castings, principally cylinder heads for aircraft engines, are X-rayed, to insure no dross inclusions, blow holes, or other defects. To guard against labor loss, all of this laboratory information is obtained before the dressing operations.

For the chipping and filing operations on heavy work, benches of heavy construction are employed. These benches are so built that they facilitate the handling of large and odd-shaped castings. Compressed air for the chipping hammers is piped to each. Hand files, both flats and half rounds from 8 to 16 in. length, are employed on the larger work, but wherever possible, flexible-shaft machines and rotary files and burs, take their places. Naturally, the choice between hand filing and machine filing for any surface rests with the workman, but a bonus plan encourages the latter.

After risers are removed from light castings (up to 50 lb.), they are removed to benches for machine filing. Most of the work coming through to the benches shown in Fig. 1 are cylinder heads for different manufacturers and the United States Government. Reference to Fig. 2 will show that such a part requires a great deal of plain and fancy filing, and that the contours of the part require a variety of file shapes.

In view of the requirements, a discussion of the principles of machine filing is in order. Considerations that must be taken into account are: contour of surface, finish required, cut of file or bur, and speed. Proper combination of the latter two gives the finish desired and is responsible for the ease and rapidity of production.

If a file is cut on a slight left-hand helix and rotated right-handed, it will cut freely and not clog as fast as files cut right-handed. Also, if a slight feather edge is employed, the cutting will be cleaner and faster. If a file having 22 to 24 cuts per inch is run at 1,725 r.p.m., the finish produced will be much rougher than when the speed is tripled. Likewise, files of different diameters, but all cut the same, will give different finishes, because of the higher surface speeds of the larger diameters. Finally, the shape, thickness, and length of a file or bur are of importance when it is remembered that it may be required to enter difficult, curved, or tight places.

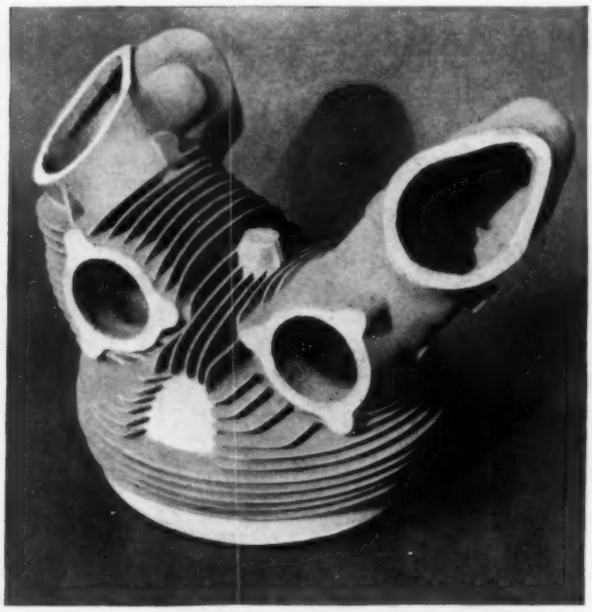


**Fig. 2—Typical aircraft engine cylinder head requiring finishing on much of the exterior and interior surfaces. Slight fins at the parting, the air-cooling fins, and the openings, all have to be gone over to insure acceptance**

As indicated above, two types of tools are available. The tools shown in Fig. 3 at *A* and *B*, are mill-cut burs, whereas *C*, *D*, and *E* illustrate hand-cut rotary files for different uses. Nearly all shapes of burs can be mill cut. They have a smooth shearing action similar to a milling cutter. Rotary files give finishes nearly comparable to hand files. The choice between a file or bur depends on the contour, speed, alloy to be worked, quantity of metal to be removed, and finish desired. The selection should usually be left to the manufacturer.

Cleaning up between the cooling fins of the cylinder head shown in Fig. 2 is the most difficult operation performed at the benches. These cylinder heads are built for various manufacturers and the space between the fins varies considerably. Therefore, four different milled-toothed burs of the type shown at *A*, Fig. 3, are employed. The first is approximately 0.125 in. at the point, tapering back to 0.175 in 2 in.; the second approximately 0.198 in. at the point and tapering to 0.250 in. in $2\frac{1}{2}$ in.; the third approximately 0.222 in. at the point, tapering back to 0.250 in. in $2\frac{5}{8}$ in.; and the fourth approximately 0.228 in. at the point and tapering back to 0.250 in. in $2\frac{3}{8}$ in. The operation consists of holding the cylinder in the vise with the fins running at right angles to the face of the vise jaw. The operator places the bur between the fins, having the end slightly ahead of the center of the casting. As shown in Fig. 4, this appears like a prying operation on the up stroke, which is a shearing cut. The operator runs the tool along the left-hand side of the groove and returns it on the right-hand side. Since a mill-cut bur has a radius point and is cut with a wavy edge, one or two passes is sufficient to secure a smooth finish.

Fine finishing on all the parts is carried out with the file shown at *C*, Fig. 3, which is cut much finer than the others, since the operation requires the removal of little stock. This particular rotary file has 28 cuts per in., an over-all length of $4\frac{1}{8}$ in., and a ball diameter of $\frac{1}{2}$ in. Another rotary file of the same general contour has 22 cuts per in. and is used for finishing the outside of the blower shown in Fig. 5. All of these surfaces are on the outside of the casting where the hollow part of the file as well as the point may be used in finishing some of the smaller radii.

If a comparatively smooth finish is demanded, with fewer scratches than are left by a file, for example, a 16-flute spiral-cut bur, shown at *B*, Fig. 3, may be employed, particularly around the port holes and rocker arm holes of cylinder heads. A shallow open flute is used on such a bur. The aluminum comes out freely and clogging is minimized.

Contours about the nosepiece and the rocker-boxes of

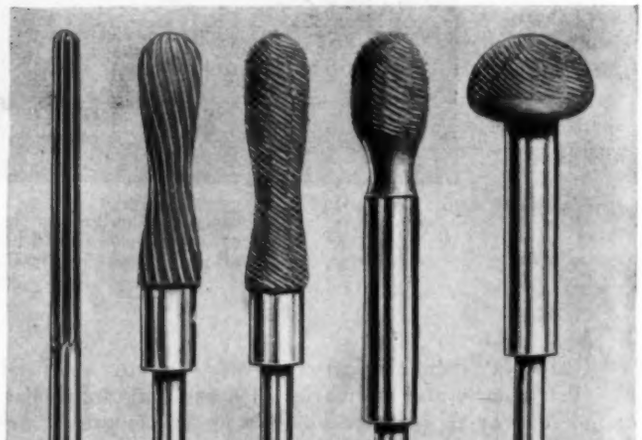



**Fig. 3—Representative mill-cut burs and rotary files used on aluminum castings. *A* and *B* are burs, and the rest rotary files. *C* and *D* can be used on a wide range of radii on exterior surfaces. *E* is adapted to internal work**

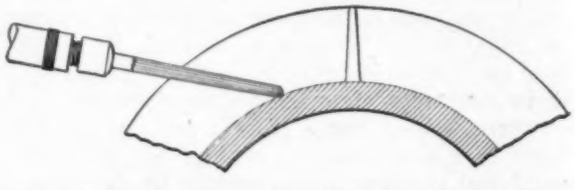


**Fig. 4—Manipulation of a straight taper bur in the fins of a cylinder head. The point is constrained to move in the bottom of the groove, much like a prying operation, and is held against the sides of opposite fins on successive passes**

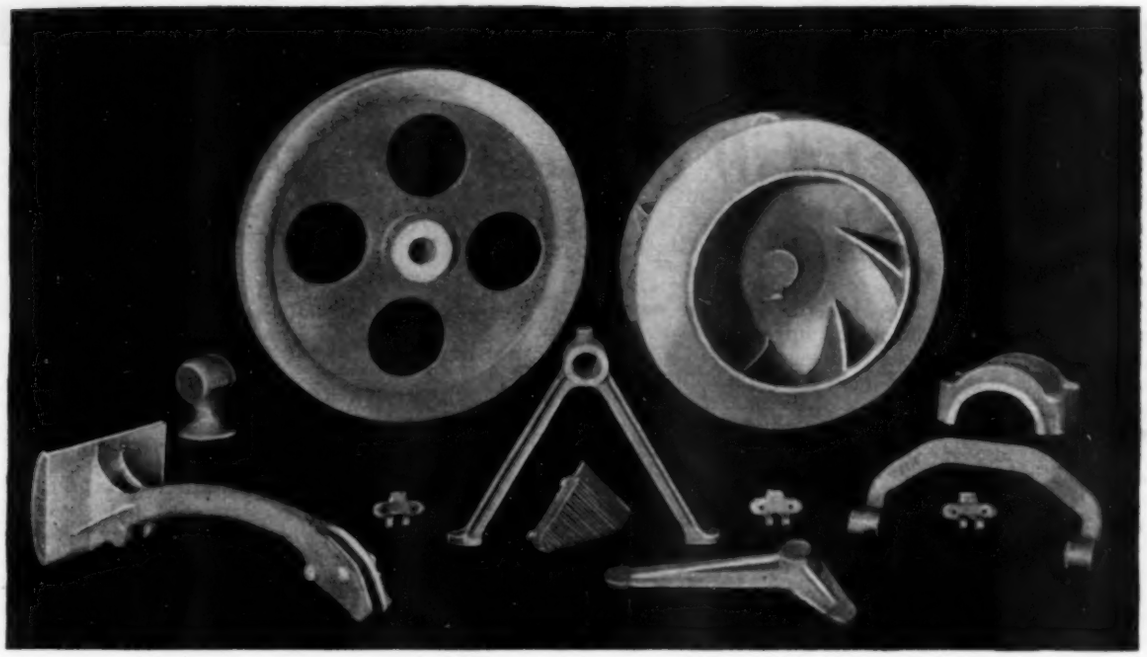


**Fig. 5—Typical light castings produced at the Fairfield plant**

these cylinder heads require entirely different files than do those described above. The file, shown at *D*, Fig. 3, has a $\frac{3}{4}$-in. ball, 22 cuts per in., and an over-all length of $4\frac{3}{4}$ in. This file is also cut left handed. A similar tool $\frac{1}{2}$ in. in diameter and $4\frac{1}{8}$ in. over-all is used on the fillets not accessible with the shorter files.

Finishing within a casting usually demands a file of the shape shown at *E*, Fig. 3. This particular file is used for finishing inside the blower shown in Fig. 5. It is 1 in. in diameter at the ball, which has 22 left-hand cuts per inch. An over-all length of $4\frac{1}{8}$ in. enables it to reach all parts of the interior.

Even the best of file finishes are more or less rough, depending upon the speed, the cut of the file, and the position in which the tool is held by the operator. Therefore, the casting is sand-blasted to give it a frosty finish. If the correct file or bur has been used, this operation will take out all file marks without trouble.

Flexible shaft outfits used for the filing operations described are belt driven, utilizing ball-bearing countershafts. The motor runs at approximately 4,700 r.p.m., a flywheel being provided to maintain even speed.

Both the files and the flexible-shaft outfits used at the Fairfield plant are supplied by the Hergi Manufacturing Company, Bridgeport, Conn.

■

## Centerless Grinding of Steel Bars

REVERE CHAPELL

MILD grades of steel, such as cold-rolled stock or drill rod, present few difficulties to be overcome. When hot-rolled bars are ground, and particularly when they are of such tough alloys as nickel, chromium, or manganese steels, the resistance to the grinding wheel's cut becomes so great that a disappointing production is likely to discourage the production manager.

There is a choice of remedies that may be attempted to relieve such a situation: The revolution of the work may be increased, which, with the same regulating wheel angle, will pass the bars between the wheels faster. In this case, the grinding wheel will probably act softer, that is, wear faster. The more rapid wear will keep the grinding wheel surface sharper by the dressing action of the work, but probably to an uneconomical degree. The angle of the regulating wheel head may also be increased to pass the bar through faster until choking takes place and relief by wheel wear occurs.

Obviously these two methods should be employed to the limit before any other course is considered.

A combination of the proper wheel, the maximum regulating wheel angle, and the maximum work revolution provides the maximum production. If such a combination is already in use, there is only one course that will give relief—to increase the speed of the grinding wheel.

The 6,500 S.F.M. speed set by the wheel manufacturers was established so long ago that nobody remembers why it was arbitrarily selected as the maximum for vitrified wheels. Today, the manufacturers of wheels are unable to account, by any logical reasoning, for the fixation of 6,500 S.F.M. as the speed above which their wheels are not safe.

Those whose production suffers by wheel speed limitations would do well to inquire into the evidence supporting the idea that wheel breakages are caused by speed. The evidence, they will find, is negligible.

It is not my purpose to discuss the advantages of high speed from a theoretical or scientific standpoint. Any wheel may be tried at a higher speed, and any wheel will cut better and take less power and will heat both itself and the work less if run faster.

The sturdy bearings of the centerless machines resulted from the requirements of grinding wheels running at too slow peripheral speed. The object of grinding a long bar is to remove surplus stock rapidly, and the contest between the wheel and the steel is less likely to result in the defeat of the wheel if it has the advantage of the utmost in speed.

# AMERICAN MACHINIST 1930 INVENTORY

## *of Metal-Working Equipment*

THIS GROUP covers makers of a wide variety of electrical products including: batteries, conduits, control apparatus, fuses, generators, household appliances, ignition and industrial apparatus, wire and cable, lamps, motors, instruments, radio, telephone and telegraph apparatus, and transformers. Five years ago *American Machinist* reported the electrical industry as having 41 per cent of equipment over ten years old which was somewhat better than the 44 per cent average for all industries.

The present compilation discloses an increase to 46 per cent of old equipment, an appreciable amount for half a decade. Why this progressive industry should permit this lag in equipment replacement is difficult to understand. It may possibly be charged to a lack of systematic obsolescence evaluation on the part of these plants. Despite the rise in the old equipment ratio, the percentage for the electrical manufacturers is lower than that for any industry thus far reported with the exception of the automotive and aircraft. However, the trend is in the wrong direction. Today, if ever, the need for high production efficiency is essential to profit.

**Report No. 11—Equipment used in the manufacture of electrical machinery, apparatus, and supplies.**

PER CENT OF EQUIPMENT INSTALLED
Prior to 1920
1920-1929
PER CENT OF TOTAL IN EACH MACHINE GROUP
56 44 Turning 23.5
46 54 Drilling 17.8
48 52 Presses, Power 10.9
46 54 Grinding 5.9
53 47 Milling 6.9
45 55 Presses, Hand 6.0
46 54 Riveting 4.0
44 56 Threading 3.0
30 70 Polishing, Lapping and Honing 2.9
39 61 Shears 2.3
65 35 Welding 2.3
50 50 Cutting-off 1.8
53 47 Shapers and Slotters 1.8
71 29 Boring 1.4
33 67 Bending and Straightening 1.3
36 64 Gear Cutting 1.0
34 66 Hammers 0.7
73 27 Planing 0.6
50 50 Wire Forming 0.4
89 11 Forging 0.2
41 59 Broaching 0.2
45 55 Centering 0.1
50 50 Keyseating 0.1
46 54 AVERAGE

## Machines in Plants Making Electrical Equipment

| | Total Number in Plants 1930 | Number Installed Before 1920 |
|---|---|---|
| LATHES | | |
| Engine | 7,048 | 4,672 |
| Hand Turret | 2,453 | 1,389 |
| Power Turret | 1,729 | 576 |
| Automatic and Semi-Automatic | 227 | 183 |
| Chucking (Not Chucking Machines) | 388 | 87 |
| Speed and Bench | 6,654 | 4,733 |
| Crankshaft | 26 | 9 |
| Toolroom Type | 2,061 | 969 |
| Other | 1,502 | 428 |
| CHUCKING MACHINES (Not Chucking Lathes) | 331 | 192 |
| SCREW MACHINES | | |
| Hand | 3,493 | 2,218 |
| Automatic, Single Spindle | 4,506 | 2,166 |
| Automatic, Multiple Spindle | 1,467 | 428 |
| CENTERING MACHINES | 192 | 87 |
| MILLING MACHINES | | |
| Hand (No Power Feed) | 2,175 | 1,371 |
| Bench | 472 | 227 |
| Plain (Knee and Column Type) | 3,720 | 1,904 |
| Universal (Knee and Column Type) | 1,729 | 882 |
| Vertical (Knee and Column Type) | 498 | 262 |
| Lincoln Type Manufacturing | 166 | 105 |
| Continuous, Rotary Table or Drum Type | 79 | 52 |
| Planer Type | 26 | 9 |
| Other | 376 | 105 |
| GEAR CUTTING MACHINES | | |
| Rotary or Milling Type | 463 | 341 |
| Hobbing | 672 | 79 |
| Planing or Shaping | 140 | 35 |
| Other | 17 | 9 |
| BORING MACHINES | | |
| Horizontal Boring, Drilling and Milling | 734 | 515 |
| Vertical Boring Mills | 934 | 533 |
| Other | 70 | 26 |
| JIG BORERS | 114 | |
| DRILLING MACHINES | | |
| Radial | 1,685 | 777 |
| Upright, One Spindle | 8,384 | 3,598 |
| Upright, Two or More Spindles | 3,668 | 1,633 |
| Upright Gang (Two or More Heads) | 882 | 515 |
| Sensitive, One Spindle | 4,812 | 2,349 |
| Sensitive, Two or More Spindles | 3,109 | 2,078 |
| Sensitive Gang (Two or More Heads) | 131 | 26 |
| Two, Three and Four Way | 175 | 52 |
| Other | 969 | |
| THREADING MACHINES | | |
| Single Spindle Tapping | 3,222 | 1,598 |
| Multiple Spindle Tapping | 533 | 61 |
| Pipe Threading and Cutting | 279 | 87 |
| Bolt Threading and Cutting | 210 | 87 |
| Thread Chasing | 26 | 17 |
| Thread Hobbing and Milling | 70 | 17 |
| Thread Rolling | 166 | 148 |
| Other | 157 | 26 |
| PLANERS | | |
| Open Side | 140 | 131 |
| Double-Housing | 594 | 402 |
| SHAPERS | | |
| Vertical | 419 | 166 |
| Horizontal | 1,764 | 987 |
| Slotters | 210 | 105 |
| KEYSEATING MACHINES | 122 | 61 |
| BROACHING MACHINES | 279 | 114 |
| GRINDING MACHINES | | |
| Plain Cylindrical | 1,598 | 306 |
| Universal Cylindrical | 410 | 306 |
| Surface, Reciprocating | 1,930 | 899 |
| Surface, Rotating | 847 | 541 |
| Internal | 323 | 131 |
| Cutter | 943 | 428 |
| Floor, No Feed Attachments | 2,087 | 1,065 |
| Bench, No Feed Attachments | 1,834 | 603 |
| Abrasive Disk | 1,319 | 795 |
| Abrasive Belt | 445 | 157 |
| Centerless | 148 | 9 |
| Other | 1,336 | 795 |
| POLISHING AND BUFFING MACHINES (Including those in Plating and other Depts.) | | |
| Abrasive Wheel, Hand Operated | 3,205 | 1,013 |
| Abrasive Belt, Hand Operated | 148 | 52 |
| Automatic and Semi-Automatic | 472 | 87 |
| LAPPING MACHINES | 52 | 9 |
| HONING MACHINES | | |
| CUTTING-OFF MACHINES | | |
| Parting Tool Type | 70 | 26 |
| Power Hack Saw | 1,074 | 489 |
| Rotary Cold Saw | 332 | 157 |
| Bandsaw | 402 | 218 |
| Other | 576 | 341 |
| WIRE FORMING MACHINERY | | |
| Spring Coiling | 140 | 70 |
| Other | 419 | 210 |
| WELDING AND CUTTING MACHINES | | |
| Resistance Welding, Butt | 201 | 26 |
| Resistance Welding, Spot | 1,441 | 114 |
| Resistance Welding, Seam | 70 | 9 |
| Resistance Welding, Other | 26 | |
| Arc Welding | 987 | 17 |
| Electric Cutting | 61 | |
| Gas Welding | 210 | 17 |
| Gas Cutting | 79 | 17 |
| RIVETING MACHINES, STATIONARY | | |
| Pneumatic | 183 | 70 |
| Hydraulic | 3,484 | |
| Power | 1,729 | 183 |
| PRESSES | | |
| Punching Machines | 2,733 | 533 |
| Combined Punches and Shears | 105 | 52 |
| Hand, Arbor | 4,017 | 1,310 |
| Hand, Light Punch Press Work | 1,100 | 559 |
| Foot, Light Punch Press Work | 2,960 | 1,164 |
| Power, Crank Type | 7,039 | 3,685 |
| Power, Toggle Type | 271 | 210 |
| Power, Double Acting | 288 | 96 |
| Power, Dieing Type | 314 | 44 |
| Power, Trimming Presses | 227 | 75 |
| Power, Forcing, Arbor, Wheel | 1,511 | 926 |
| Hydraulic, Bending, Forming, Drawing | 1,284 | 961 |
| Hydraulic, Wheel Forcing, etc. | 148 | 105 |
| Baling, Power and Hydraulic | 105 | 44 |
| Other | 507 | 131 |
| BENDING AND STRAIGHTENING MACHINES | | |
| Bending Brakes | 943 | 288 |
| Bending Rolls, Horizontal | 314 | 166 |
| Bending Rolls, Vertical | 26 | |
| Straightening Rolls | 166 | 70 |
| Other | 166 | 17 |
| SHEARS | | |
| Knife | 2,288 | 934 |
| Rotary, Slitting | 559 | 227 |
| NIBBLING MACHINES | 183 | 35 |
| HAMMERS | | |
| Drop | 349 | 218 |
| Helve | 35 | 9 |
| Spring | 306 | |
| Steam | 26 | 26 |
| Pneumatic (not portable) | 35 | 17 |
| Other | 157 | 35 |
| FORGING MACHINES | | |
| Bulldozers | 61 | 44 |
| Hot Forging Machines | 17 | |
| Cold Headers, Bolt, Nut, etc. | 96 | 87 |
| Cold, Swaging | 175 | 105 |
| Forging and Flanging Presses, Hydraulic | 17 | 17 |
| Other Forging Machines | 35 | 26 |
| Total | 133,712 | 61,703 |

# IDEAS FROM PRACTICAL MEN

## An Improvement in Taps
### *Discussion*

HARTLEY KIBBE

COMMENTING upon the article by Charles A. Pease, under the title given above, on page 62, Vol. 73, of the *American Machinist*, I wish to offer the following:

In the first claim, Mr. Pease says "The cut starts very lightly, the teeth cutting at the crests only." Where the teeth cut at the crests only, they break or crumble easily, while the broad, low teeth are strong. The improved tap having so long a taper, cannot be used for bottoming holes, or for tapping long, deep holes of small diameter, on account of the small chip room. Most chips would be made where the taper meets the full diameter, or where the last finishing cut is taken. At this point, the flutes are smaller because of the taper. The heaviest chips are cut near the point of a common tap and fall ahead of the threaded part into the hole, leaving the flutes quite free from the first few chips. Thus the broad chip is best for both the tap and the work.

The cutting friction of the improved tap produces heat and wear, which is much greater than that of the common tap, as can be seen by comparing the combined lengths of the V-shaped cuts with the lengths of the plain cuts. Inasmuch as the chips are thinner, the greater must be the surface-cutting contact of the improved tap, and care must be taken or the chips will become so thin that the tap will wedge and not cut at all, except in short nuts, where the cutting will depend upon the length of the tapered thread.

In the second claim, Mr. Pease says "The first teeth do the least work, as should be the case." I do not agree with him. The low, strong teeth of the common tap should do the most work, and the sharp crests should do the least work. In the improved tap, the teeth that finish the thread have to do the greatest amount of work. The first teeth should do as much work as they can possibly be made to do without danger of reaming, that is, not following the correct lead. How much of a cut the first teeth should take varies, as a chamfer is required where taps are to be used in screw machines. About ten or twelve threads chamfer is standard for tapper and nut taps.

It is the force behind the tap that counts. Sometimes the tap is pushed forward by hand, or machine, and sometimes, after a short forward push, the tap has to pull a heavy turret, or carriage along, which exerts a pulling-out force on the tap. I claim that the tap should be helped to get a start on its heaviest cut.

In the third claim, Mr. Pease says "With the common tap, the first tooth takes a cut of the same width as that of its base, leaving only the slender tips of the threads in the hole between cuts." This condition is not as serious in the nut as in the improved tap which is more fragile at the tooth points of the entering end. V-thread taps, as shown by Mr. Pease, are practically obsolete, and the U.S.S. taps have flats at the roots of the teeth, strengthening the crests of the threads in the nut. Furthermore, nuts are usually drilled so that about 75 per cent only of the thread will be left, which leaves plenty of the nut teeth between the teeth of the tap. If the tap is kept sharp, the crests of the teeth in the nut will not break off during the tapping, leaving imperfect threads. The improved tap, which does take a very narrow cut at first, leaves most of the work of removing the stock to teeth farther back, and the load on the tap increases as it goes in.

With the ordinary tap, especially in tapping nuts, the first few threads, taking the heavy cuts, are through working and the teeth have less to do as the tap passes through the nut. The wide, strong lands between the threads, as specified for the improved tap, are of no benefit, as has been explained, except when the tap crawls or reams. At present, some taps are made without any relief whatsoever on the outside and the pitch diameters. Such tops are comparatively hard cutting, but they cut to size. Other taps are relieved on these diameters, and are free cutting. If relieved taps are forced too hard, or conditions are such that they cannot travel forward freely, they will ream or go off lead until they take hold in the work. However, if they are handled properly, they will cut better than taps that are not relieved, and will not load.

In the fourth claim, Mr. Pease says "With the ordinary tap, a portion of the side of each thread is successively formed by each tooth, which portion is not to any extent affected by successive teeth. By this action, the successive teeth only deepen the cut, leaving the sides of the threads a succession of single, fairly-heavy cuts, and therefore rough. In my tap, the taper cuts progressively at the sides of the threads as well as at the bottoms, shaving the sides gradually by thin, shaving cuts. This action produces the same effect as that of the finishing cut made with a 'series' tap."

In a lathe or planer, the finishing cut in cast iron is taken with a rather broad, half-scraping cut, and while the improved tap may be all right in cast iron, it will not do so well in steel. In turning steel, a sharp tool is used at a fine feed to produce final finish. This principle is used in the common tap, where each tooth finishes a little of the sides of the threads until the thread is completed. The idea of a "series" tap is not to produce a smooth finish in steel, but to remove most of the stock so that the succeeding taps will not be under too great a strain. We know that in the improved tap, the last cut is the broadest or longest, as it cuts on both sides of the thread.

Take a cold chisel of a width equal to the sides of a thread and try to cut a chip of equal thickness as the finishing cut in any material. The chisel will hardly mark the surface, to say nothing of taking a bite. After enough blows, when it does take hold, a lot of power is required to force it along. This condition proves that

the final tooth of the improved tap, if used in steel, will be hard to take hold and to force along. Consequently, it will resist motion to the point of heating and tearing the threads. The common tap, when the nut is bored oversize, is greatly relieved of the broad chip and will shave out the stock with the least resistance, and with good results.

The so-called improved tap takes more power and has more localized strain than the common tap. Its tapping speed is not faster than that of the common tap, as claimed, since tapping speed depends upon rotative speed and other factors. It is more subject to breakage than is the common tap, although it cuts smoother in such material as cast iron, and starts with correct leads more quickly. But the improved tap and its good points are not new. It is described in old trade catalogs, and its tapered end is termed "taper in angle."

■

## Tandem Washer Die

CARL GOTTHARDT
*Connecticut Tool & Engineering Company*

The use of rubber heels on men's shoes is now almost universal even on the cheaper grades. They wear faster than leather and must, therefore, be changed oftener, and that these changes be not frequent enough to prejudice the wearer against their use, the nails that hold them to the shoe must be arranged as close to the shoe as possible to allow maximum wear.

Rubber itself does not hold small headed nails well, and so a number of small steel washers are imbedded and molded in the rubber heel. It is desirable that these washers be of the same outside diameter so that they will feed through the magazine of the rubber molding machines without clogging.

For the production of such washers, the punch and die, shown in Fig. 1 are made of high chromium acid-hardening steel. The diagonal layout allows of sufficient space between the larger openings and the grouping of the smaller punches. If laid out straight it would be necessary to place these latter in double rows also. It will be noted that the arrangement is really that of two dies in tandem, giving it a capacity of 24 washers per stroke of the press. This multiplied by 300 r.p.m. gives a possible capacity of 7,200 washers each minute.

The sequence of the operation is easily recognized by reference to the strip of perforated material. Cupping is done at rows number 1 and 5, and the center distances

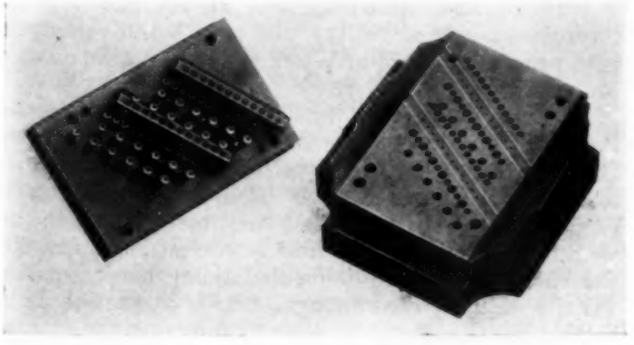


**Fig. 1—Punch, punch plate and die for 7,200 washers per minute**

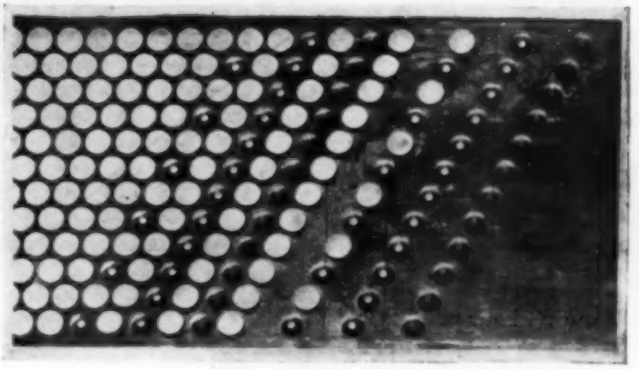


**Fig. 2—Section of material showing duplicate arrangement in tandem**

between the different rows of perforations are arranged so that the maximum amount of material is utilized.

It will be noticed that the cupping is done by the punch alone, and that it is not necessary to "bottom" it in the die to get the desired result. The fact that the material usually follows the punch is lost sight of by many die makers. In the present instance, bottoming the punch would prevent the die being ground when it became dull. The punch, however, does strike the material solidly to prevent any possible tendency to buckle. Four guide pins maintain accuracy.

■

## Finding the Centers of New Teeth in a Repaired Gear—*Discussion*

GEORGE BELBES
*Production Engineer, Gaertner Scientific Corporation*

In an article under the title given above, on page 812, Vol. 72, of the *American Machinist*, H. Moore describes a method of finding the centers of new teeth in a gear repaired by welding new metal in the space left by the broken teeth. He also tells of cutting the tooth spaces by filing. In discussing Mr. Moore's article, Richard H. Kiddle, on page 64, Vol. 73, tells how he modified Mr. Moore's methods, and suggests cutting the tooth spaces in the shaper.

It seems to me that Mr. Moore's methods are tedious and inaccurate, while Mr. Kiddle's are quite expensive if the vise centers and pawls, described by him have to be made. I have solved such a problem by filing a tool to the contour of one of the tooth spaces, giving it proper clearance, hardening it, and using it as a fly cutter in a milling machine. The gear was mounted on a mandrel supported on centers. A block on the table of the machine was used for indexing, allowing the good teeth in the gear to rest upon it in succession.

■

## Turning Grooved Flywheels

CHARLES C. TOMNEY,
*Tool Designer, Brunswick-Kroeschell Company*

V-belts are now being used extensively, and our method of turning, facing, boring, and grooving flywheels to accommodate them may interest other readers who have to use a boring mill like ours with no side head.

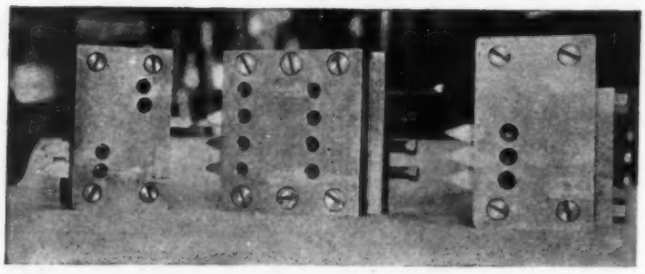


Fig. 1—Multiplé toolholders for two, three, and four grooving tools

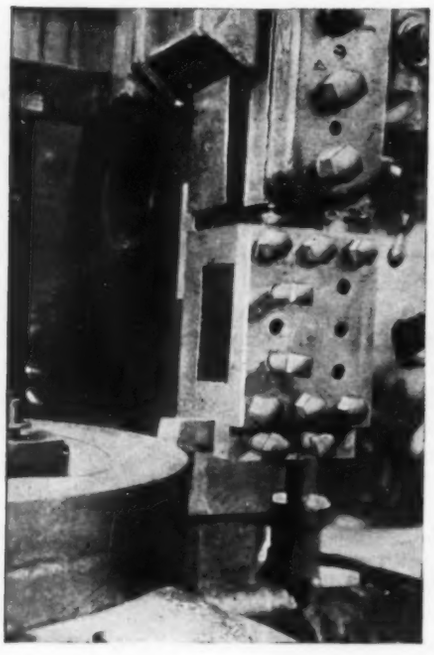


Fig. 2—The toolblock may also be used as an ordinary toolholder

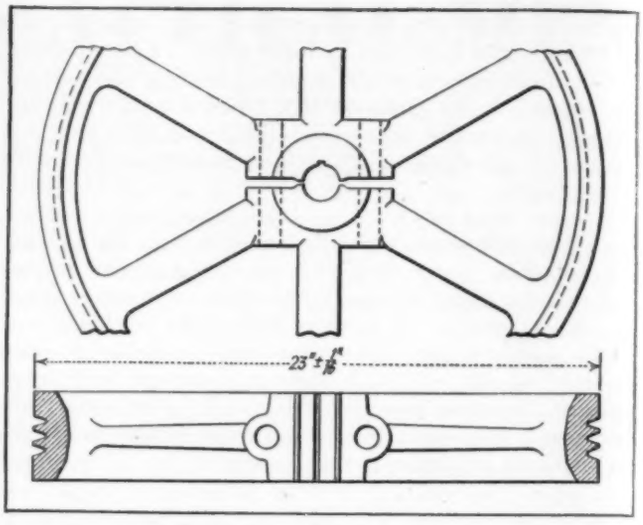



Fig. 3—Flywheel to be turned and grooved

Fig. 4—Grooving tools in operation

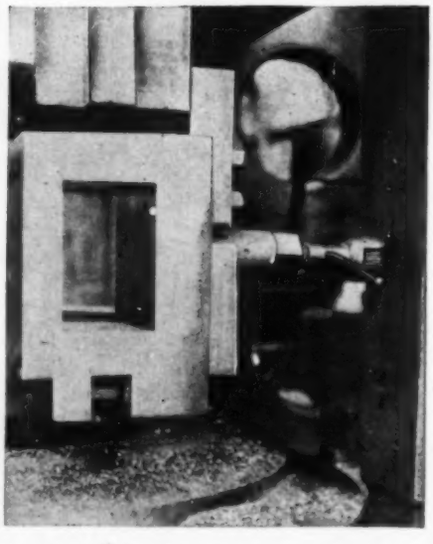


Fig. 5—Unique backing device to resist the high cutting pressures

The grooving toolblock was designed to be left in the mill while performing turning and facing operations on flywheels many of which are not grooved. One of its advantages is that it may be used as an ordinary toolholder, as shown in the illustration.

After turning the outside diameter and facing the lower rim, the single tool is removed and the multiple-cutting tool is inserted in the opening of the toolblock. We then center the multiple tool with a special gage and proceed to groove, finishing in one cut on the size illustrated. For 30-in. flywheels with four grooves, we found it necessary to use a multiple roughing cutter as well. The toolhead is held in place by two setscrews.

When grooving three- or four-groove wheels, the body of the toolblock is likely to shift or twist as it has a round shank. A flat is milled in the shank which is held in position by two more setscrews. To overcome the twisting, a plate is bolted to the back of the toolblock, the same width as the body of the tool and having a nice fit. To eliminate chatter when grooving the larger wheels, we made a roller head jack, and bolted it to the body of the toolblock. The roller remains in contact with the face of the housing when the tool is fed inward giving ample support to insure a smooth finish.

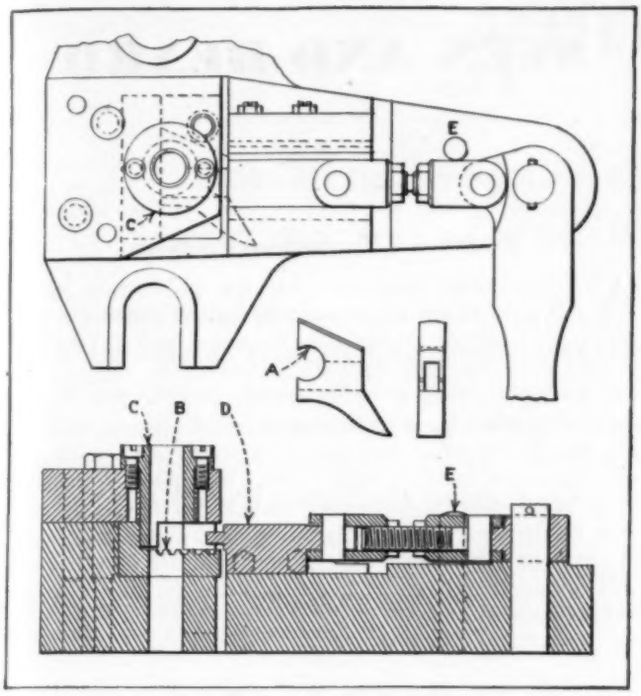
■

## A Reaming Fixture

CARL E. SCHINMAN
*Production Engineer, Aero Production Company*

The fixture illustrated was designed for holding the drop-forged jaws of wrenches, such as the one shown at *A*, while the holes were being reamed. As the hole breaks through one side of the jaw and runs into a rectangular hole previously machined, the job presents an unusual problem.

Accurate location of the jaw in relation to the side through which the hole breaks, and to the rectangular hole, is necessary. Therefore, the fixture was designed to clamp the jaw in such position that its bottom surface would bear against the nest block *B*, and with the rectangular hole held in correct alignment with the bushing *C* by the tit on the sliding block *D*, which fits the width of the rectangular hole. A portion of the bottom of the bushing is cut away to permit the entrance of the work. The sliding block is gibbed in a dovetailed slide. The adjustable connecting link is pivoted to the




sliding block and to the operating lever. Pin *E* acts as a one-direction stop to prevent the connecting link from being carried past the center.

In operation, a set of these fixtures is clamped to the table of a gang drill, being aligned with the spindles. The work is slipped under the bushing and is approximately located by a stop pin. Then the sliding block is advanced by operating the lever, the tit engaging in the rectangular hole, forcing the work against the nest block and clamping it securely. Two operations of reaming, roughing and finishing, are required, the bushing being changed for each operation. Four-fluted high-speed core drills are used as reamers.

■

## Indexing a Long Shaft—*Discussion*

J. T. Miller
*London, England*

In an article under the title given above, on page 60, Vol. 73, of the *American Machinist*, L. W. Bloier tells how he indexed a shaft that was too long for the milling machine. His use of a change gear, borrowed from the lathe department, while a good method of indexing, is an old one. Mr. Bloier was lucky, not only in finding a change gear having the proper number of teeth for the work, but in being able to control the turning of the shaft so as to provide a seat for the gear.

A somewhat similar job was once given to me. The shaft in question was 6 in. in diameter and 16 ft. long, and it overhung the table of the milling machine 12 ft. Since I had no control over the turning of the shaft, there was no way of attaching a change gear to it for indexing. However, I managed to do the job in the following way: I took a sheet of tin of heavy gage and on it scribed a circle 24 in. in diameter, and divided the circle into six divisions. A hole was bored in the center of the circle, so that the tin was a wringing fit on the shaft. Putting the tin on the shaft, near the end of the table, it was tacked by a couple of spots of solder.

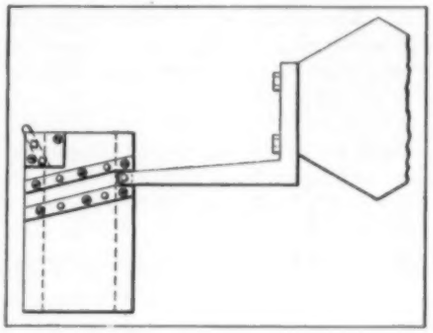
Having clamped the shaft in V-blocks and supported the overhanging end by an open sling suspended from a pair of chain blocks, I hung a plumb bob from the shaft, close to the tin. After turning the shaft until one of the divisions was in line with the plumb line, the shaft was clamped in the V-blocks and the first cut was made. For indexing for the next cut, since the tin rotated with the shaft and the plumb line was stationary, it was necessary only to unclamp the shaft and rotate it until the next division on the tin came in line with the plumb line.

■

## Power Cross-Feed for Turret Lathes

Ernest Foldvary
*Consulting Engineer*

By the simple device shown in the illustration, power can be applied to the cross-feed of turret lathes where no such provision has been made originally. Hardened strips are placed at an angle on the top of the toolblock, the angle depending upon the rate of feed desired. A roller carried by a bracket attached to one of the turret faces is fitted between the angular strips. Forward movement of the turret will cause the toolblock to move inward, while rearward movement will have the opposite effect. When the turret is moved by power, motion will be transferred to the toolblock through the roller and the angular strips, giving a positive and regular feed.



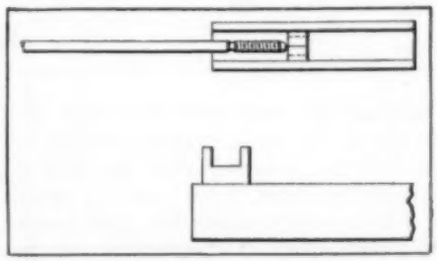
The toolbit is set in a holder attached to one corner of the toolblock, and the cross-feed screw is removed so that the toolblock may be allowed free movement by means of the mechanism described. If desired, other tools can be set on the same face of the turret.

■

## Fixture for Retapping Nuts

Charles R. Whitehouse
*Standards Engineer, The Holtzer-Cabot Electric Company*

If nuts are not retapped after they have been plated, or have been put through a rust-proofing process, they will be too tight a fit on the bolts. A simple fixture for holding nuts while they are being retapped is shown in the illustration. It consists of a rectangular piece of steel slotted to form a trough slightly wider than the distance across the flats of the nuts to be retapped, as



shown in the illustration, and welded to a piece of steel fitting the toolpost of the lathe.

The device is held in the toolpost, and a long-shanked tap is held in the chuck, the threaded end projecting about 2 in. into the trough. When a nut is dropped into the trough and pressed against the tap, engaging the threads, it will run up the threaded part of the tap and onto the shank, automatically, being prevented from turning by the walls of the trough. As soon as the nut has travelled far enough for the end of the tap to project through it, another nut is started on its way. When the shank of the tap has become filled with nuts, the tap is taken out of the chuck and the nuts are emptied into a receptacle.

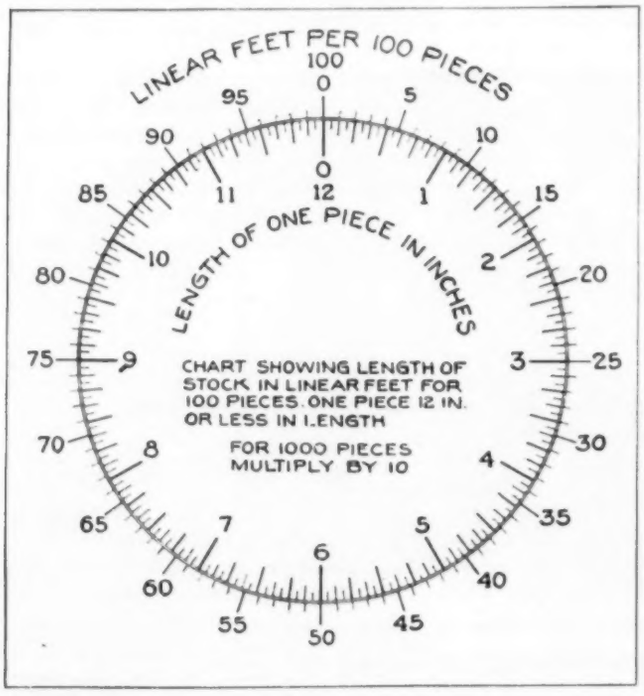
■

## Chart for Checking Stock Lengths

J. K. Olsen
*Chief Draftsman, Stewart-Warner Corporation*

A chart which may be used for checking the required length of stock per 100 pieces of a part not exceeding 12 in. in length is shown in the accompanying illustration. The chart is not planned for accurate determination of stock lengths, but is offered only as a reference or a means of checking other figures, as the divisions give only approximate results.

The following example will give an illustration of the chart's use: Supposing 1,000 pieces of insulated wire were to be purchased, each piece to be $7\frac{3}{16}$ in. long, how many feet of wire would be required? $1{,}000 \times 7\frac{3}{16} = 7{,}187$ in. This, divided by 12, = 599 ft. Checking this figure from the chart we find opposite the $7\frac{3}{16}$-in. mark




approximately 60, and as the chart furnishes only the lengths required per 100 ft. we must multiply the 60 by 10, which will give 600 ft., showing that the 599 is correct. In the customary manner, 5 per cent for scrap allowance should be added, which makes the final figure 630 ft. required per 1,000 pieces.

# SEEN AND HEARD

•

### Scales as a Production Problem

ANYONE who imagines that the production man's job is monotonous has another guess coming. Just the single question of scale on forgings, sheets, or heat-treated parts can keep him from sleeping on the job. It isn't much of a trick to cut under the scale with any good tool. But when it comes to punch and die work, scale on the sheet can raise hob with the tools and with the surface of the finished work. Scale also adds to the cost of grinding wheels and other tools. So the production man has to watch new developments in pickling, sand blasting, or other methods of scale removal. And that is only one of the phases of manufacturing on which he has to keep posted.

### Finding Data When Wanted

ONE CONCERN which makes a large amount of special equipment has adopted a system of filing a blueprint of each special fixture in a compact and easily accessible cabinet. These prints are grouped according to kind rather than by order numbers or names of customers. All gear grinding fixtures, for example, are grouped together. Then, when an order or inquiry about any gear grinding job comes along, a brief study of this file will probably unearth a fixture that will do the trick. Or, if slight modifications are necessary, the time required is much less than for designing an entirely new fixture. In too many cases a shop has information of this kind tucked away where it can seldom be found when needed.

—*J. R. G.*

### Where Should the Engine Be?

A FEW far-seeing engineers are beginning to wonder how the automobile engine ever happened to be placed at the front of the car, and how long it will stay there. Need for accessibility, in a day when much engine tinkering was necessary to keep 'er going, doubtless had a lot to do with the present location, but happily we are well past that stage.

Reasonable accessibility would not have to be sacrificed if the engine were placed back of the back seat, for example. There noise would be less audible, and heat, as well as fumes, would be carried away from, rather than toward, the occupants of the car—very real advantages. No radical change in external appearance of the car would necessarily accompany such a change, at least at first. A front hood could remain, providing space for gravity-feed fuel tank, a battery, more leg room, and useful storage. Seats would be placed a foot or so farther forward and riding comfort increased. Mechanical problems involved are less difficult than they may seem. Apparently the advantages quite outweigh the drawbacks.

This, at least, is what we hear from advocates of such a change, and there seems to be a lot in what they say.—*N*

# Non-Metallic Spur Gear Horsepower Formulas

**REVISION of the recommended practice of the American Gear Manufacturers' Association, with reference to formulas for computing the horsepower of non-metallic spur gears composed of laminated phenolic materials or rawhide, was completed at the Association's recent Niagara Falls meeting. Where former practice showed values for 14½-deg. gears only, the present revision includes values of Y for both 14½ and 20 deg.**

$$HP = \frac{0.000095 \times SWS \times FW \times Y \times PLV}{DP}$$

Where:

HP = horse power

SWS = safe working stress of material (varies with speed. See value of SWS in table below)

FW = face width in inches

Y = constant depending upon number of teeth (see values of Y in table next column)

PLV = pitch line velocity in feet per minute

DP = diametral pitch

VALUES OF SWS

For pitch line speed in feet per minute

| PLV | SWS | PLV | SWS | PLV | SWS |
|---|---|---|---|---|---|
| 100 | 4500 | 700 | 2500 | 1700 | 1974 |
| 150 | 4071 | 800 | 2400 | 1800 | 1950 |
| 200 | 3750 | 900 | 2318 | 1900 | 1929 |
| 250 | 3500 | 1000 | 2250 | 2000 | 1909 |
| 300 | 3300 | 1100 | 2192 | 2200 | 1875 |
| 350 | 3136 | 1200 | 2143 | 2300 | 1860 |
| 400 | 3000 | 1300 | 2100 | 2400 | 1846 |
| 450 | 2885 | 1400 | 2063 | 2600 | 1821 |
| 500 | 2786 | 1500 | 2029 | 2800 | 1800 |
| 600 | 2625 | 1600 | 2000 | 3000 | 1781 |

6,000 lb. was used as the safe working stress for static load and with the formula

$$\left(\frac{150}{200 \times PLV} + 0.25\right) \times 6{,}000 = SWS \text{ in above table.}$$

VALUES OF Y

(14½ and 20 degree involute)

Full depth or stub tooth

| Teeth | Y | | Teeth | Y | |
|---|---|---|---|---|---|
| | 14½ Deg. | 20 Deg. | | 14½ Deg. | 20 Deg. |
| 12 | 0.067 | .078 | 27 | 0.100 | .111 |
| 13 | 0.070 | .083 | 30 | 0.102 | .114 |
| 14 | 0.072 | .088 | 34 | 0.104 | .118 |
| 15 | 0.075 | .092 | 38 | 0.107 | .122 |
| 16 | 0.077 | .094 | 43 | 0.110 | .126 |
| 17 | 0.080 | .096 | 50 | 0.112 | .130 |
| 18 | 0.083 | .098 | 60 | 0.114 | .134 |
| 19 | 0.087 | .100 | 75 | 0.116 | .138 |
| 20 | 0.090 | .102 | 100 | 0.118 | .142 |
| 21 | 0.092 | .104 | 150 | 0.120 | .146 |
| 23 | 0.094 | .106 | 300 | 0.122 | .150 |
| 25 | 0.097 | .108 | Rack | 0.124 | .154 |

Values for Y same as used in Lewis Formula.

A.G.M.A. formula was derived from the Lewis Formula for horsepower as follows:

$$HP = \frac{W \times PLV}{33{,}000}$$

$$W = SWS \times CP \times FW \times Y$$

substituting

$$HP = \frac{SWS \times CP \times FW \times Y \times PLV}{33{,}000}$$

changing CP to DP

$$HP = \frac{\frac{\pi}{DP}(SWS \times FW \times Y \times PLV)}{33{,}000}$$

clearing fractions

$$HP = \frac{0.000095 \times SWS \times FW \times Y \times PLV}{DP}$$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### *Licked at the Start*

THOUSANDS of dollars are wasted daily in metal-working shops either in scrap or in needless salvaging operations, merely because somebody didn't think or work hard enough to get the "bugs" out of some earlier operation, one in which the faults should have been licked in the first place. When put in that light, the fact may seem obvious. Perhaps that's why it is overlooked so frequently.

When one stops to analyze such a situation, it is easy to see that it's far better to do the job "that can't be done" in the first place, rather than to rig up and waste time and money in trying to fix up faults that never should have occurred. Almost any shop executive can cite instances in which exactly that has happened.

If you can't remedy a fault yourself, it's pretty safe to say that *somebody* can, and that it will be cheaper to get it done right than to keep on performing needless operations.

Time will be well spent if every man in charge of production work will stop to analyze every operation performed on a piece and ask himself, "Now exactly why is this operation required? Could it possibly be avoided if some earlier operation were improved?"

### *Paradox*

MEN of science co-operating with men of business have long since been working on the basic subject of fatigue. And they seem pretty well to have determined the four more important general causes: poor emotional adjustment; body condition or lack of condition; environment; fatiguing methods of work.

Jim is engaged in work he does not like; for him it is monotonous; he is not adapted to it. Jim has no real rest periods during the morning and afternoon shifts; lactic acid and carbon dioxide build up in his body; he is "tuckered out" most of the time. Jim works in a poorly lighted shop; his eyes are kept in a constant state of tension; their tension extends to his whole body. Jim lifts heavy castings to a machine instead of rolling them along a conveyor, if he had one. It should be no secret that the production in Jim's shop disappoints every one from himself to his foreman to the stockholders.

The successful competitors of Jim's firm have long since placed their particular Jims at work which they like and to which they are adapted. Knowing that in heavy work fatigue is relieved and production increased by three minutes of rest after every twelve minutes of work, they provide for rest periods. They furnish adequate light, soundly engineered conveyors, insist on the proved work methods discovered through motion study.

As Donald A. Laird, director, Colgate Psychological Laboratory, points out in "Scientific American" for August, "It is a paradox of mankind that by resting at proper times men can do more work with less fatigue."

### *Five Per Cent*

HIDDEN away in a paper given some time ago by W. L. Churchill is a small story with large implications. It should bear repeating.

A consulting engineer was called in by the well nigh desperate president of a medium-sized plant to find means, any means, to resuscitate earnings. Stockholders and directors were insistent; something had to be done.

Very shortly the engineer found a way to reduce the cost of all products five per cent. In the presence of the firm's sales manager, he reported the cheering news to the president. The sales managr pricked up his ears. "Fine," said he, "now we can reduce our prices five per cent and sell a whole lot more goods."

Said the engineer, "Hold on a minute. I thought you people asked me to find ways to restore your profits to a proper level. This cost reduction will enable you to do it if you sell no more than at present and get only your current prices. If you intend to throw these profits overboard in an effort to take other peoples' business from them, I do not care to submit the plan to you or anyone like you."

# SHOP EQUIPMENT NEWS

## LeBlond No. 5 ACP Automatic Crankshaft Pin Finish Turning Lathe

To eliminate the rough grinding operation on pin bearings of automobile crankshafts, a type 5 ACP machine has been developed by the R. K. LeBlond Machine Tool Company, Cincinnati, Ohio, for finish turning the diameter and facing the side walls simultaneously. This machine resembles the type 5 AC. The simple mechanical principle employed lends itself to an unusually heavy machine, the weight of which is about 45,000 lb.

Because of the orbital motion required, two like master cranks are geared with the spindle. These cranks are connected with a carrier mounting the tool block on the front face. Both master shafts are positioned with relation to the spindle so that the cutting compound, chips, and dirt cannot get into the bearings. The lower main crank is located in a base compartment, where it receives continuous lubrication. The upper crank is carried in a cradle that pivots at the driving intermediate gear center, and the tool carrier members are connected with the upper crank by means of short connecting rods. Feeding movement of the tools is controlled by the motion imparted to the cradle. The spindles are placed to allow the machine to be loaded easily.

A cross-section of the machine when the tools are withdrawn from the work is given in Fig. 3. When the cranks revolve in this position, the path of the tool is in the form of an ellipse. This is obtained from the driving gears on the top crank revolving around the intermediate gears as the cradle is moved back. Thus the two master cranks are caused to get out of index in relation to each other. As the cradle advances the tools toward the work, the elliptical path is gradually reduced.

Fig. 4 shows a cross-section of the machine when the tools are finish cutting on the pins. In this position the cradle has been moved up and held against the positive stops in the housings. At this location, both master cranks have then moved into correct index with each other, and the tools are moving in a true circular path. The cradle is actuated by a hydraulic cylinder through a rack, gear, and toggle motion. With this toggle arrangement, the feed of the tools decreases automatically as they near the pins. This gives a large displacement of oil in the cylinder and a very powerful feed. When the cradle

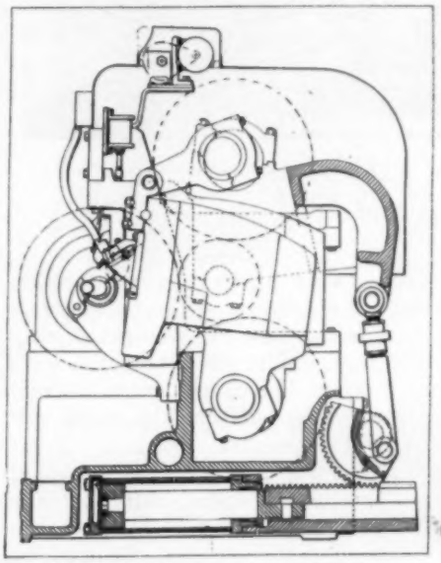


**Fig. 3—Cross-section showing the tools withdrawn from the work**

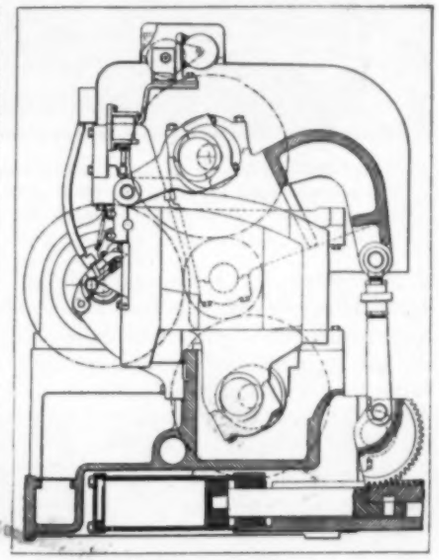
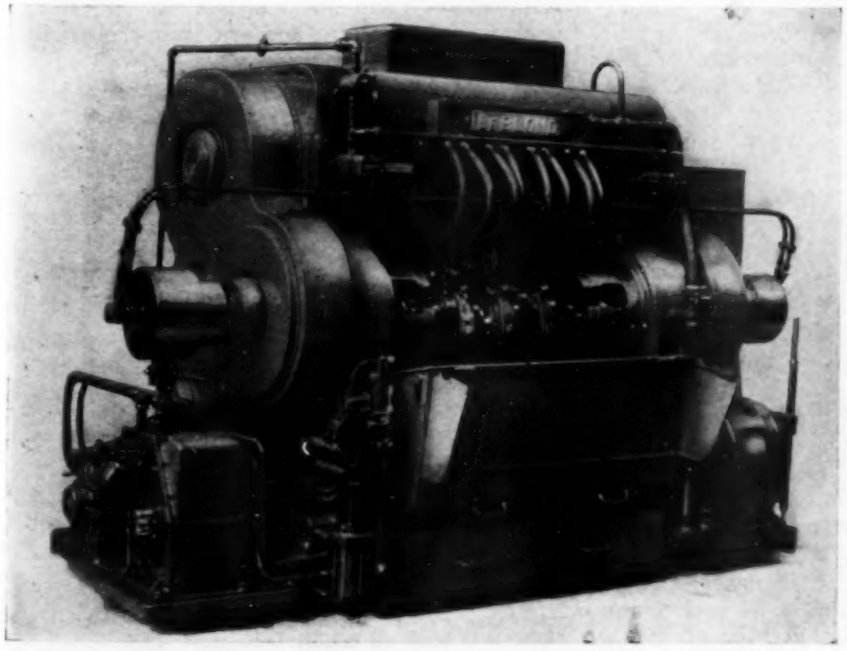


**Fig. 4—Cross-section showing the tools finish cutting on the pins**



**LeBlond No. 5 ACP Automatic Crankshaft Pin Finish Turning Lathe, which attains a production of 25 to 30 cranks per hour, leaving 0.0035 in. on the walls of the pins for finish grinding and 0.020 in. on the diameter**

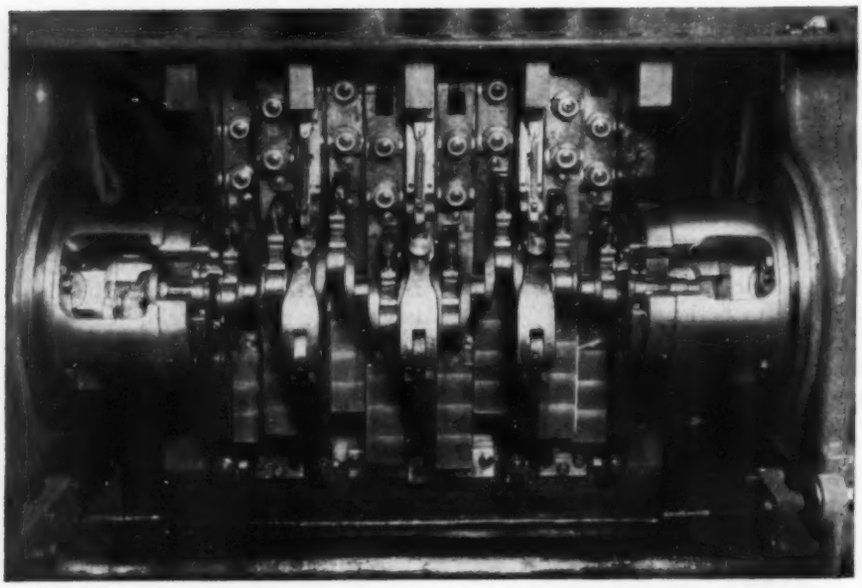


**Fig. 2—The crank is held and driven at the flange and stub ends. To facilitate rapid loading, the front part of each chuck is constructed so that the crank slides through the guide opening to position**

is fed against the stops on the housings, the pressure in the feed cylinder rises to a predetermined amount and the oil is bypassed through a relief valve to a cylinder that reverses the flow. The cradle is then rapid traversed to its original position.

The crank is held and driven at the flange and stub ends. To facilitate rapid loading, the front part of each chuck is constructed as shown in Fig. 2, so that the operator just places the crank in the guide opening and it slides into position. The crank is held in a half bush, in the main body of the chuck, by two jaws, each of which is operated by a plunger. This plunger has a double taper on the front end that rapidly advances the jaw and then locks it in a clamping position on the work. An equalizing yoke connects the two plungers with the rod of the large air cylinder.

To drive the crank, spots are milled on the webs adjacent to both the flange and stub end bearings. On one end of the flange end chuck there is a positive gage block against which the crank is held. An adjustable stop is brought up to bear against the finished spot on the stub end to eliminate the springing of the crank, because the milled spots are not in line with each other. The crank is held against these stops by a small air cylinder, which operates a swivel link through a locking plunger and lever. One motion of the air control valve operates both tandem cylinders, and the volume of air is controlled so that the clamping jaws and driving dog function in certain relation with each other. The chucks are positioned automatically so that the work can be removed easily.

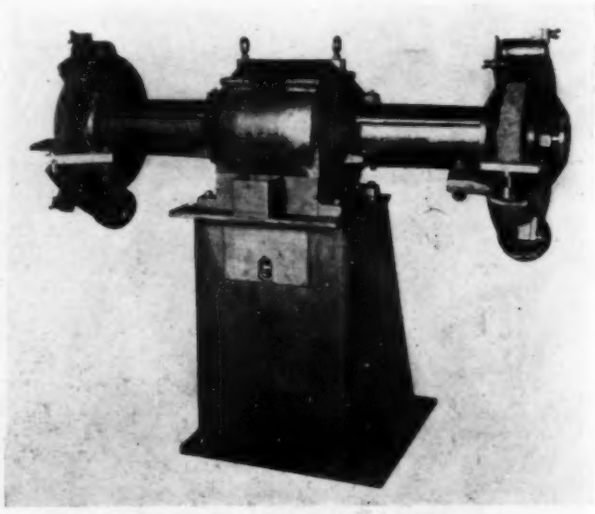
Three work supports are provided on an eight-cylinder crank for the center main bearings. The caps on these supports are also clamped by air. The bearing faces of all the tool carriers are lined with high chromium steel plates, which resist wear or cutting action. Accurate adjustment is provided on these units for changing the diameters of the pins on the work. The weight of the lower tool carrier units is carried on the lower main crankshaft to insure rigidity. Both the upper and lower master cranks are exactly alike, and on an eight-cylinder crankshaft there are five main bearings in which the master crank in the base revolves. The end main bearings are 9 in. in diameter and the three center bearings, 11 in. in diameter. The weight of each crank is 1,700 lb.

The spindles are mounted on large Timken bearings with accessible means for adjusting. The chucks for driving the work are bolted to the flange end and the tandem air cylinders for operating the chucks are mounted on the rear of the spindle. Automatic forced feed lubrication is supplied to all bearings. The oil supply is carried in the base of the machine and is pumped through a filter. A 25-hp. motor is used for driving the machine and the work spindles revolve at 30 r.p.m.

The exceptional rigidity of this 45,000 lb. unit, combined with the accurate master shafts, produces a crankshaft with a minimum amount of material to be removed in finish grinding. On the walls of the pins 0.0035 in. is allowed on each side for grinding and 0.020 in. on the diameter. The slow speed at which the pins are machined produces a smooth finish, with a production of 25 to 30 cranks per hour.

## "One Profit" Extended-Arm Pedestal Grinder

A wide spread between the two wheels on the "One Profit" extended-arm pedestal grinder, developed by the Production Equipment Company, Cleveland, Ohio, permits the grinding of awkward and clumsy shapes. The motor is completely inclosed and requires no ventilation. Thus, the construction excludes all dust, dirt and grit from the windings



**"One Profit" Extended-Arm Pedestal Grinder, built up mainly from steel shapes**

or bearings. Four heavy-duty ball bearings, two in each extended arm, provide rigidity and strength to the extra-heavy nickel-steel spindles. The greatest part of the grinder, especially the base and accessories, is constructed from steel shapes, formed and welded.

## Fitchburg Production Milling Heads

Special milling machines for the varied requirements of automotive and large industrial plants can be designed around the production milling heads announced by the Fitchburg Engineering Corporation, Fitchburg, Mass. With these heads, it is possible to build heavy production machines having a dozen or more spindles without the use of complicated transmission systems, since each head is driven by its own 1,200 or 1,800 r.p.m. motor. Furthermore, changes in the design of the products manufactured can be met by changes in the frame of such machines and fixtures, and the relocation of the heads where necessary. Finally, existing equipment can be modified by the addition of such heads, and thus the expense of entirely new single-purpose machines is saved.

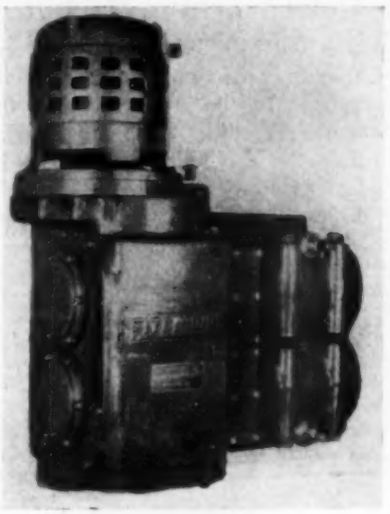


**Fig. 2—Fitchburg Double-Spindle Production Milling Head with right-hand spindles**

A case in point is the installation during the present year at the Plymouth Motors plant of the Chrysler Corporation in Detroit. As shown in Fig. 3, a drum-type milling machine has been changed over to accommodate changes made in the design of the cylinder block. Since four of these machines underwent changes, the savings effected will be readily appreciated as being considerable.

The Fitchburg milling head is made in three spindle sizes, 3, 4, and 5 in., and each is equipped with an individual motor. Both right- and left-hand spindles can be had. These heads are suitable for mounting in any position, and can be arranged for permanent mounting or placed on suitably gibbed slide surfaces on the main casting, so that they can be adjusted or fed along as required.

The spindle and spindle drive member are mounted in precision-type tapered roller bearings. Drive to the spindle is by a chilled, phosphor-bronze worm wheel engaging a hardened and ground worm. The spindle speed may be varied up or down by pick-off gears accessible from the outside of the head. Spindle bearings are adjustable by the removal of simple corners. Two special plug binders have been provided to prevent the quill moving under heavy cuts.

Standard 1,200 or 1,800 r.p.m. motors are employed on these heads. The entire drive mechanism is self-lubricated by means of the oil contained within the head. Should a major change be made in the product to be milled, the spindle speeds can be changed materially by changing two elements in the head. Another feature of the head is its small size, which results in savings in floor space.

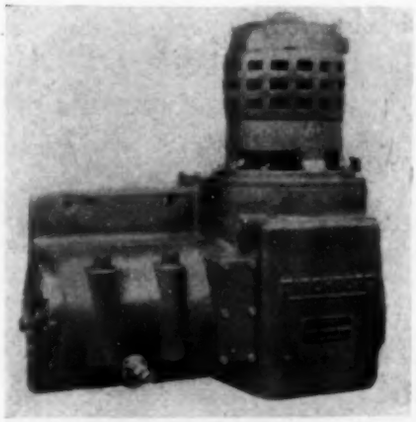


**Fig. 1—Fitchbury Production Milling Head with single left-hand spindle**

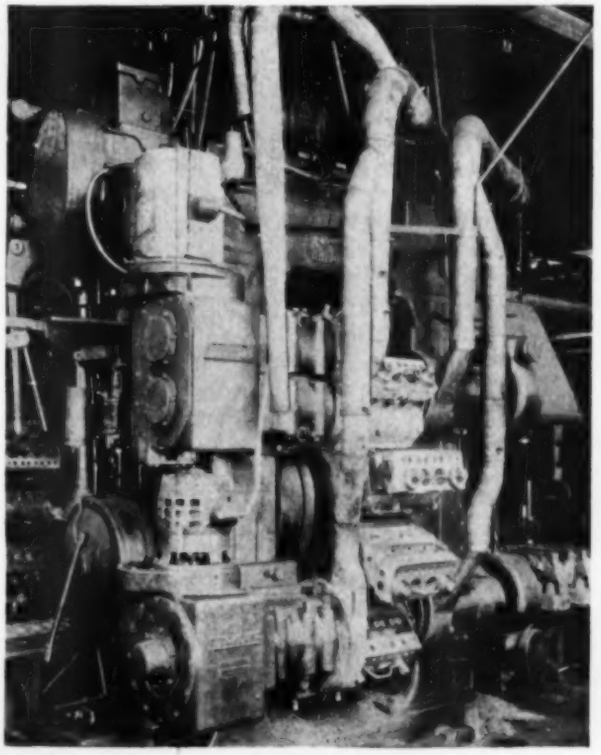


**Fig. 3—Drum-type production milling machine at the Plymouth Motors plant, Detroit, for machining cylinder blocks. This production machine has one 4-in. double-spindle Fitchburg milling head and one 5-in. single-spindle head**

## "Calite F" Heat-Resistant Alloy

A nickel-chromium alloy that possesses the quality of casting in comparatively thin sections has been recently announced by the Calorizing Company, Wilkinsburg Station, Pitttburgh, Pa. It is known as "Calite F" and is particularly recommended for thin-wall carburizing boxes, annealing pans, enameling

racks, and other furnace fixtures. The material has a maximum safe working temperature of 1,900 deg. F., at which the safe load is 1,250 lb. per square inch.

When cast in the form of a box, the sections may be $\frac{3}{16}$ to $\frac{1}{4}$ in. in thickness, so that the total weight compares favorably with sheet containers, but has the rigidity of a casting. Carburizing boxes can be made according to customer's specifications. These boxes are "calorized" or coated with a thin film of aluminum on the inside to prevent corrosion from sulphur, present in most carburizing compounds, and also to prevent penetration of carbon. These boxes are available in any commercial size.

## Elwell-Parker 1¾ and 10-Ton Lift Trucks

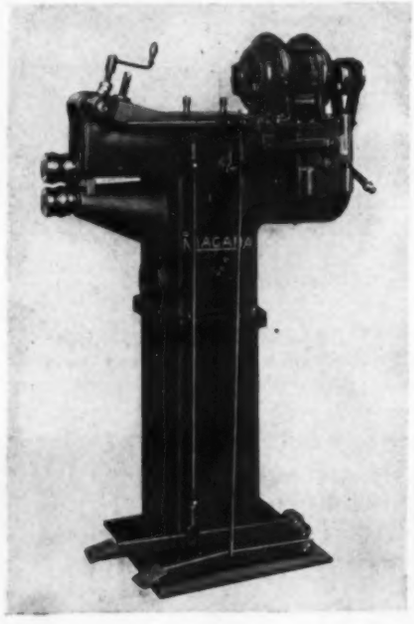
Two electric lift trucks of similar design and widely varying capacity have been announced by The Elwell-Parker Electric Company, Cleveland, Ohio. The big truck shown has a rated capacity of 10 tons. The lift platform measures 40 x 144 in. and stands 18 in. from the floor. The small truck standing on the platform of the larger was developed to handle hand lift truck skids and is rated at 1¾ tons. Its platform dimensions are 18 x 41 in., and it has a 7-in. clearance.

Drop forged parts are employed throughout both machines and the loads on each are carried by the front axle. Timken bearings are employed for the steering mechanism. On the smaller machine, the front wheels are steered simultaneously with the drivers by a pump handle, horizontal tiller or wheel to suit the wishes of the user. On the larger machine all four axles steer concentrically with the drivers on the other axle. The inside wheels turn approximately 33 deg. while the outside pair of wheels turn at 29 deg. Thus, when the operator swings the steering wheel, the front wheels move through an arc of 62 deg. beneath the 10-ton load.

**Both are of the same family — Elwell-Parker 1¾- and 10-Ton Lift Trucks**

## Niagara No. 180 Sheet Metal Working Machine

The No. 180 heavy, power-driven, combination machine for sheet metal operations has been developed by the Niagara Machine & Tool Works, Buffalo, N. Y. This machine is suitable for metal parts of all types and for general plant maintenance work. It has a maximum capacity of No. 14 gage mild steel, and is designed for the regular operations of turning, wiring, crimping, beading, slitting and flanging. Special rolls can be designed for unusual operations.



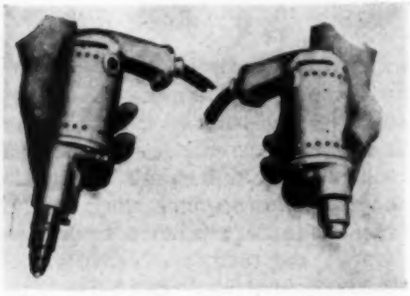
Single pulley drive or belted motor drive through a self-adjusting, ball-bearing idler can be furnished. Motion of the rolls is controlled by a clutch that responds instantly to hand or foot control.

The vertical adjustment of the top roll is made by a crank handle and treadle, each working independently of the other. The crank handle is arranged so that it clears the work in any position.

## Black & Decker "Universal Twins"

A $\frac{3}{16}$-in. electric drill and a small electric screw driver comprise the "Universal Twins" announced by the Black & Decker Manufacturing Company, Towson, Md. These tools have been designed for work in close quarters and consequently are very short in length and have small body diameters.

The screw driver is equipped with an adjustable friction clutch, which drives the screw "flush" and releases



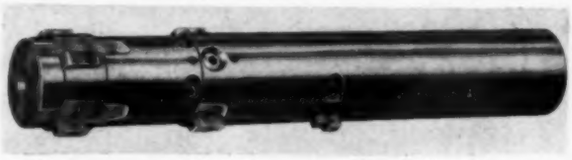
immediately without marring the screw head or the surrounding surface. This clutch can be set to any desired tension by means of a knurled thumb screw on the gear case. It

can also be adjusted for driving various types and sizes of small screws, and to compensate for the different conditions in driving into wood or metal. In addition, this screw driver has a positive clutch that allows the spindle to remain idle for finding the slot in screw. This positive clutch engages the bit only when pressure is exerted, and thus serves to prevent marring the work.

The drill is equipped with a three-jaw, geared chuck of $\frac{3}{16}$-in. capacity and has a universal ball-bearing motor. It can be furnished for 110-, 220- or 250-volt circuits.

## Davis Four-Cutter Car-Wheel Boring Tool

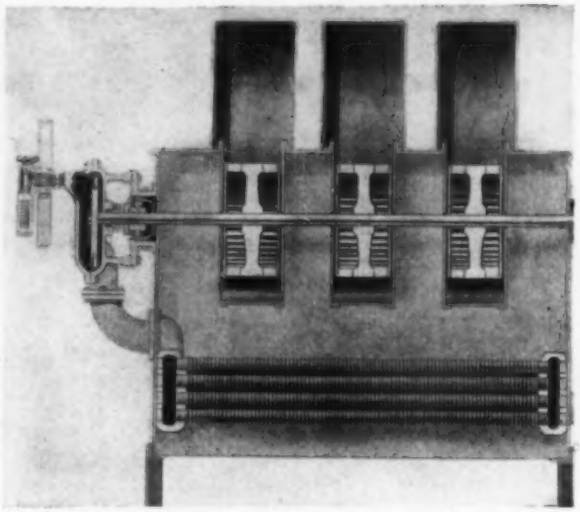
With four cutters instead of two, the car-wheel boring tool developed by the Davis Boring Tool Company, 6200 Maple Ave., St. Louis, Mo., is capable of feeds from two to three times those formerly used on this work. On one installation, roughing, finishing and chamfering cuts were made on cast-iron wheels in one minute and five seconds, the floor-to-floor time being two minutes and thirty seconds. This was accomplished on a boring mill running at 20.2 r.p.m., and utilizing a $\frac{5}{8}$-in. feed.



This four-cutter car wheel boring tool has the same expansion unit as the regular type "L" Davis boring bars, with the exception that it is in a vertical position. When the micrometer screw is turned, the wedge is brought forward, expanding all the cutters equally. The cutters are furnished in high-speed steel, Stellite, and cobalt- or tungsten-carbide. Hardened Stellite wearing strips are placed at the side of the blades to prevent chips from cutting the bar.

## "Turbo" Unit-Heater

Complete independence from electrical control systems, motors, and wiring is the feature of the "Turbo Heater" developed by the Automatic Turbo Heater Company, 343 South Dearborn St., Chicago, Ill. This unit heater makes use of a low-pressure turbine to drive the fans. An impulse-type turbine is employed, having a steel rotor, stainless steel buckets, and a nozzle with an adjustable needle valve. A thermostatic valve controls the steam supplied to the turbine. Exhaust steam from the turbine enters a condenser unit at the bottom of the casing, which is equipped with $\frac{3}{4}$ in. copper tubes with continuous spiral fins. Here heat is radiated to the air, which is circulated by means of the fans.



**Cross-sectional view of "Turbo" Unit Heater, showing the turbine, thermostatic steam inlet valve, condenser unit, and turbine-driven fans**

Steam pressures to 150 lb. per sq.in. can be employed to drive the turbine and the exhaust will never exceed 5 lb. per sq.in. The feature of this unit heater is that less than 1 per cent of the heat of the steam is employed for the turbine drive and the remainder of the steam, principally latent heat of the steam, is given to the air by means of the condenser unit. The unit heater is made in five sizes, in both the floor and ceiling type. It has a heavy casing.

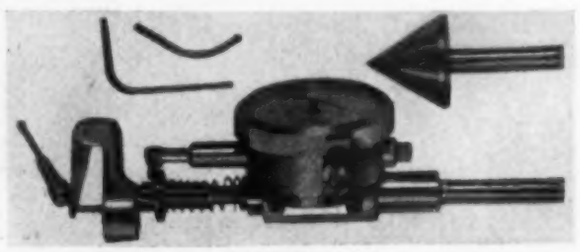
## "Schwieterman" Center Finder

Improvements have been made on the "Schwieterman" center finder manufactured by the Precision Gage & Tool Company, 320 East Third Street, Dayton, Ohio, for locating and relocating work on jig boring and vertical and horizontal milling machines. It is now equipped with a specially arranged $1\frac{1}{2}$-in. diameter Federal dial indicator.

When centering work that is to be held stationary while the spindle of the machine revolves, the usual method is to fasten the test indicator to the spindle and then revolve it by hand to four quarter positions. This, of course, is a slow process. But with some practice, work can be centered by means of the Schwieterman device within 0.0002 in. in 15 to 30 seconds.

When the center finder is to be used for locating the center of a hole, the cone center is first inserted in the chuck and the job is located within 0.010 in. to 0.015 in. The cone center is then removed and the center finder is placed in the chuck with the feeler fingers adjusted to the sides of the hole. Next, the machine is started and run at boring speed, the operator holding the test indicator with one hand and operating the machine with the other. When the indicator finger stops moving, the job is central with the spindle within 0.0002 in., and is ready to bore or locate other holes from that position.

Three quickly changeable feeler fingers are available. The No. 1 size is for holes up to $\frac{3}{4}$ in. in diameter; the No. 2 size, $\frac{3}{4}$ to $1\frac{1}{2}$ in. in diameter and also for locating buttons, and the No. 3 size, holes from $1\frac{1}{2}$ to 3 in.

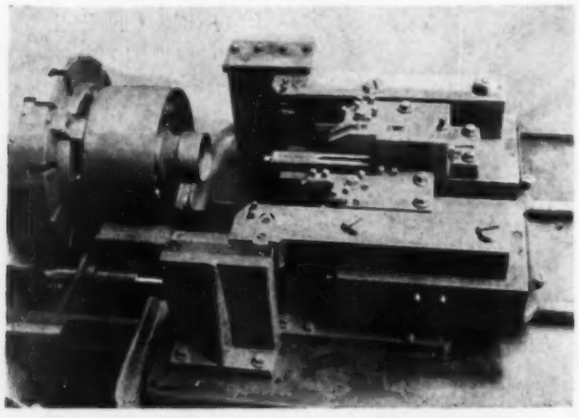


# EQUIPMENT ADAPTATIONS

## RECENTLY DEVELOPED BY THE MAKERS

### Machining Crowned Pulleys on the Gisholt "Simplimatic"

The problem of turning the crowned contour of a pulley absolutely true without a flat spot at the crown, and in addition, bore the inside of the rim, bore and counterbore the hub, turn the hub to two different diameters grooved on both sections, face the hub rim and part of the web, and round the corners, has been met by the use of a "Simplimatic" manufactured by the Gisholt Machine Company, Madison, Wis. The simple tooling for this operation is shown in the accompanying illustration. The close limits and quality of finish required necessitated roughing and finishing all turned and bored surfaces. A floor-to-floor time per piece of 9 minutes is obtained.



**Simple tooling on Gisholt "Simplimatic" for performing a multiplicity of operations on a crowned pulley**

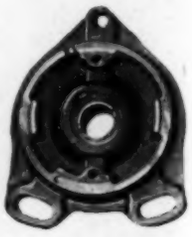
### Milling Slots in Motor End Bearing Castings

Slots in the end bearing castings for electric motors are milled at the rate of 250 pieces per hour on a "Milwaukee" No. 1 manufacturing miller equipped with a special four-spindle, adjustable, high-speed head. This machine has been developed by the Kearney & Trecker Corporation, Milwaukee, Wis. Two semi-automatic fixtures, each holding one work piece are employed and the milling is performed by means of four ½-in. profiling cutters.

The special four-spindle head is bolted to the column of the machine and is held rigid by two stub overarms. The four spindles are arranged two on each side, the top spindle on each side being mounted solidly in the head, while the bottom spindles have about ⅜ in. center-to center adjustment so that different size castings can be milled.

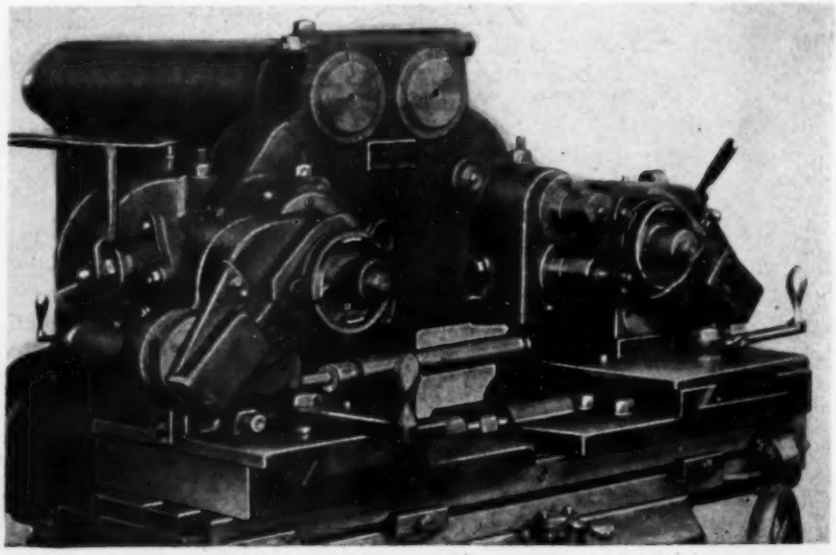
Both semi-automatic fixtures have a heavy base bolted to the milling machine table. Each base has a slide in which the top part of the fixture moves to and from the cutters. When the top part of the fixture moves in, it automatically engages the clutch, which operates a cam in the fixture, causing the workpiece to oscillate around the cutters so that they mill the inside of the bolt slots.

The operator places the workpiece on the spindle with the hole at the peak fitting over a stud, slips on a "U" washer, and turns the air valve lever clamping the piece. Next, the lever at the front of the fixture is pulled to advance the workpiece to the cutters. As the workpiece reaches the cutters, the clutch is engaged automatically, causing the casting to oscillate. While one side is in the cut, the operator steps to the other fixture, removes the piece, and repeats the operation.

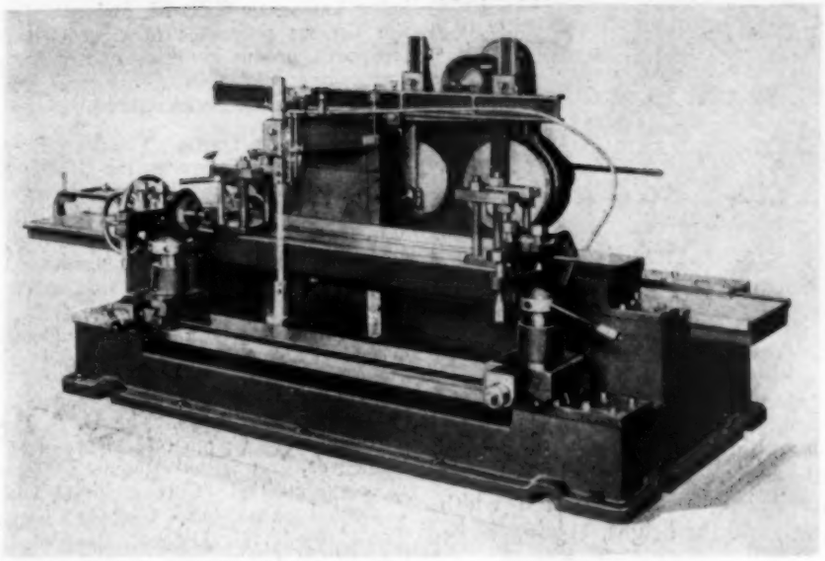


### Peerless Metal Sawing Machine with Traversing Table

Lengthwise sawing of wings from billets is facilitated by the machine illustrated. It is built by the Peerless Machine Company, 1615 Racine St., Racine, Wis. The billet handled is of three-wing clover-leaf design, the wings varying up to 10x10 in. The length of the billet is 4 ft. It is laid lengthwise in the two vises in front of the long table so that one wing rests on the table and is clamped by



**A special four-spindle, adjustable, high-speed head is used on this "Milwaukee" No. 1 Manufacturing Milling Machine to slot motor end bearing castings in the two fixtures**



Saw traverse of over 4 ft. is a feature of the Peerless Metal Sawing Machine developed for a steel mill

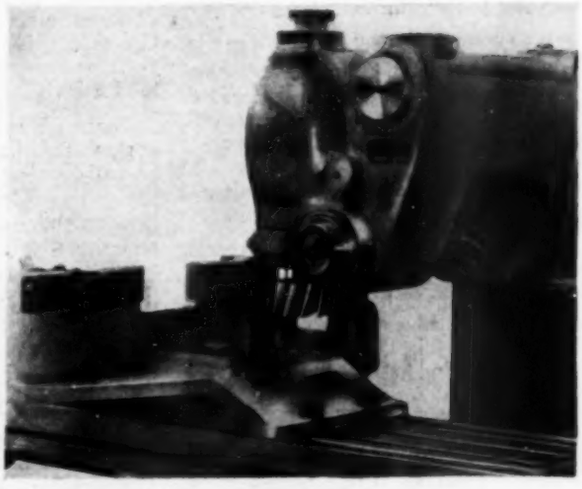
the two spring fixtures. The saw frame carries the blade crosswise and operates the blade for a distance of more than 4 ft. while reciprocating up and down. At the completion of the cut, the 10x10 in. wing rests on the long table, after which the billet may be turned over and the next wing removed in a similar manner.

## Milling Pads on Exhaust Manifolds

Both the center and neck pads on exhaust manifolds are milled in the illustrated set up of a No. 2 "Mil-waukee-Mil," a standard manufacturing type, but fitted with a special, two-spindle head. This machine was supplied by the Kearney & Trecker Corporation, Milwaukee, Wis. The cast-iron manifold is held in a special fixture, one at a time, and is finished by means of two 4½-in. shell end mills.

The special head is supported by the double overarms and gibbed to the column. It has one horizontal and one vertical spindle, the horizontal for milling the neck pad and the vertical for milling the center pad. These two spindles are set in quills to allow for adjustment. However, a quicker and simpler means of adjustment is provided by moving the knee up or down and the saddle in or out.

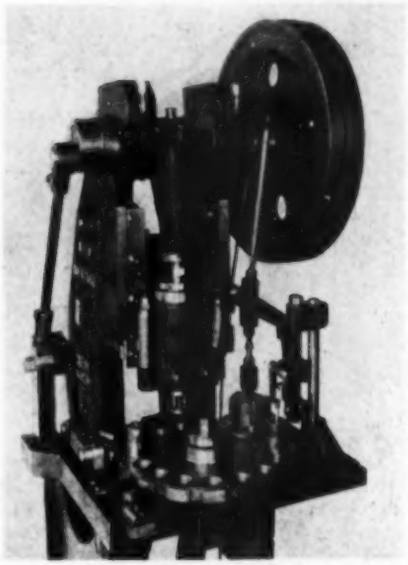
The fixture consists of a heavy angle base, against which the workpiece is clamped. The manifold is located from one hole at each end slipping over a stud at each end of the fixture. It is held against the back of the fixture by two clamps, which are tightened by hand screws. There is also a clamp at the center pad and a brace for the neck which steadies it during the cut.



Fifty exhaust manifolds per hour are milled on the pads on this "Mil-waukee-Mil" setup

## "New Rockford" Inclinable Press with Dial Feed and Automatic Pick-Off

In the illustration is shown a No. 1R "New Rockford" inclinable press of the flywheel type equipped with dial feed and automatic safety stop. It



is provided with a special knockout in the slide and an automatic pick-off for ejecting the work from the dial. This attachment was designed for simultaneously assembling the ferrules and caps on automobile choke tubes, the special spring knockout being furnished for the specific purpose of stripping the choke tubes and center pins. This pin is used to size the hole which has a very close running tolerance.

# PATENTS

OCTOBER 14, 1930

**Metal-Working Machinery**

Metal-Reworking Machine. Clarence A. Dix, Detroit, Mich. *Patent 1,778,105.*

Apparatus for Forming Tapered Tubes. Louis H. Brinkman, Glen Ridge, N. J. *Patent 1,778,181.*

Cushioning Device for Sheet-Metal Presses. Frederich J. Rode, Chicago,

Ill., assigned to Marquette Tool & Mfg. Co. *Patent 1,778,229.*

Machine for Impressing Helically-Disposed Formation in Curtain Poles. Charles W. Kirsch and Archie A. Allen, Sturgis, Mich., assigned to Kirsch Co. *Patent 1,778,032.*

Nut Machine. George S. Smith, Pittsburgh, Pa., assigned to Pittsburgh Screw and Bolt Corporation of Pennsylvania. *Patent 1,778,232.*

Tapping Machine. David Calrera Lopez, Chicago, Ill. *Patent 1,778,265.*

Drawing Press. Rudolph W. Glasner, Chicago, Ill. *Patent 1,778,358.*

Apparatus for Forming Oval Structural High-Carbon-Steel Tubes. Frank P. Vincent, Elyria, Ohio. *Patent 1,778,438.*

Grinding Machinery. Hans Ernst, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. *Patent 1,778,452.*

Adjustable Bed for Power Presses. Neal W. Damon, Arthur H. Scholz, and Meredith R. Hatch, Toledo, Ohio, assigned to The Toledo Machine & Tool Co. *Patent 1,778,486.*

Metal-Rolling Process and Apparatus. Albert R. Earnest, Buffalo, N. Y. *Patent 1,778,487.*

Headstock. Herbert E. Kempton, Chicago, Ill., and Keith F. Gallimore, Fond du Lac, Wis., assigned to The Heald Machine Co. *Patent 1,778,675.*

## "Speedmatic" Type K-9 Saw

The Porter - Cable - Hutchinson Corporation (formerly the Porter-Cable Machine Company and the Hutchinson Manufacturing Company), of Syracuse, N. Y., has placed on the market a hand power saw known as the "Speedmatic" type K-9. Although similar in appearance to the type K-8, the K-9 is of the gear-driven type. It is provided with a 1¼-hp. motor and is geared to the drive arbor through hardened spiral gears having a reduction ratio of 2½ to 1. Saw speeds are 5,000 r.p.m. at no load and 4,000 r.p.m. under the average cutting load. With the latter high speed it is possible to rip a 3 in. plank 12 ft. long in one minute; cross cut 3x6 in. in two seconds; and cross cut 2x12 in. in four seconds.

The type K-9 will cut to a maximum depth of 3⅛ in. Both depth and angle adjustments are made easily by turning a thumbscrew. The former has a 1¾ in. travel and any angle up to 45 deg. can be secured, the scale being graduated in 5 deg. The motor is cooled by a large turbine fan.

The speed of the saw is correct for

**"Speedmatic" Type K-9 Saw, which operates at 4,000 r.p.m. under load**

using thin emery wheels for cutitng soft metals. The weight is 23 lb., the overall length, 12½ in., the width, 9¾ in., and the height, 11⅛ in.

# TRADE PUBLICATIONS

ELECTRODES. The General Electric Co., Schenectady, N. Y., has published a small booklet on its welding electrodes and the various types of operation for which they are suitable, giving the chemical contents and suggested current values.

FURNACES. The General Electric Co., Schenectady, N. Y., has published catalog GEA-37F on "Direct-Heat Electric Furnaces of the Type RRB"; GEA-1174B, superseding 1174A, on the "Type RRT Conveyor Furnace," and GEA-1324 on "Air-Draw Furnaces."

FURNACES. The Hevi-Duty Electric Co., Milwaukee, Wis., has published three catalogs as follows: Bulletin No. 930 on pot-type electric furnaces; No. 1030 on electric vertical pressure carburizers, and a leaflet on "Hevi Duty" automatic temperature cutouts.

GEARS. The Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio, has published a 96-page catalog on small and medium-size gears in spur, bevel, miter, spiral, and other types. It is provided in handy pocket-size form with formulas and information on the design and adaptation of gearing and reduction units.

GRINDERS AND BUFFERS. The Van Dorn Electric Tool Co., and the Black & Decker Manufacturing Co., Towson, Md., have issued catalog No. 9 on the Van Dorn-Black & Decker line of heavy-duty grinders and buffers, giving photographs, descriptions, and specifications.

HEAT-TREATMENT OF STEEL. The General Electric Co., Schenectady, N. Y., has issued a booklet "Heat Treatment of Steel," the publication being known as GEB-83, and covering the various processes of electric heat treatment, production costs, construction and maintenance of G. E. furnaces, and various furnaces manufactured.

HIGH-CYCLE TOOLS. The Van Dorn Electric Tool Co., and the Black & Decker Manufacturing Co., Towson, Md., have issued catalog No. 2 on the Van Dorn-Black & Decker line of high-cycle tools, consisting of drills, reamers, screw drivers, nut runners, stud setters, buffers, grinders, disk sanders, and attachments. Each item is very completely described and cross-sectional views are given for each tool.

LATHE TOOL TESTS. The U. S. Department of Commerce, Bureau of Standards, has issued Research Paper No. 206 entitled "Cutting Tests with Cemented Tungsten - Carbide Lathe Tools" by T. G. Digges. It gives a method of testing cemented tungsten-carbide lathe tools under heavy duty.

NEW YORK MERCHANTS' ASSOCIATION YEAR BOOK. The Merchants' Association, Woolworth Bldg., 233 Broadway, New York, N. Y., has published its 1930 Year Book. The alphabetical list of members makes the volume an ideal book for reference and the classified list is broken down into 50 large divisions.

PIPE THREADING AND CUTTING-OFF MACHINES. The Landis Machine Co., Inc., Waynesboro, Pa., has issued bulletin No. C-61 on "Landis" 6- and 8-in. pipe threading and cutting machines, discussing the salient features, drive arrangements, various assemblies, and giving the specifications.

RUBBER GOODS. The Diamond Rubber Co., Inc., Akron, Ohio, has published a catalog on its belting, packing, hose, matting, and miscellaneous items.

SCREW THREADS, STANDARD. U. S. Department of Commerce, Bureau of Standards, has issued Commercial Standard CS24-30 entitled "American National Standard Screw Threads (Coarse and Fine Thread Series)." Copies can be secured from the U. S. Government Printing Office, Washington for $0.10.

TOOLS. The Ready Tool Co., Bridgeport, Conn., has issued catalog No. 23 on ball bearing centers, high speed centers, toolholders, grinder dogs, and boring bars. Each item is illustrated and described, and the sizes available are listed.

TUNGSTEN-CARBIDE. William Sellers & Co. Inc., Philadelphia, Pa., is distributing copies of a booklet "The Use of Tungsten Carbide as a Cutting Material on Heavy Machine Tools."

USED MACHINERY. The Monarch Machinery Co., 300 North Third St., Philadelphia, Pa., has issued bulletin No. 135, which is a stock list of its used machinery.

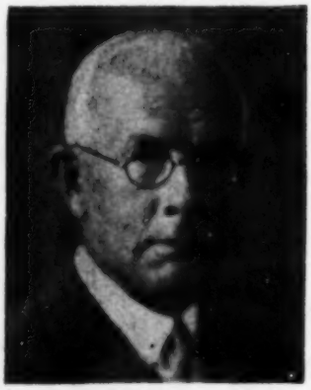
# NEWS OF THE WEEK

## Machine Tool Builders Will Study Markets

THE high point of the 29th annual meeting of the National Machine Tool Builders' Association was the decision to authorize the board of directors to initiate analysis of the markets for machine tools; 133 representatives of 75 member companies attended the meeting which was held on Oct. 13-15 at the Aspinwall, Lenox, Mass.

Reporting for the committee which had been studying the project, Frederick V. Geier, vice-president, The Cincinnati Milling Machine Co., presented his case so clearly and effectively that the affirmative vote was unanimous. Preceding Mr. Geier's address was a confidential report on the obsolescence survey recently conducted by *American Machinist*. The report was made by K. H. Condit, editor and publishing director. The figures developed by this survey were used by Mr. Geier to check his own calculations and to emphasize the importance of the replacement market.

In his brief opening remarks, Pres. C. A. Johnson, Gisholt Machine Co., commented on the greater equanimity



C. A. Johnson

with which the members of the association seem to be accepting the present industrial depression. He urged them to put their houses in order for the improvement in business that is beginning to make itself evident.

F. H. Chapin, president, National Acme Co., H. S. Beal, assistant general manager, Jones & Lamson Machine Co., and R. A. Heald, secretary, Heald Machine Co., were elected to the board of directors for a term of three years. The new board organized by re-electing C. A. Johnson to the presidency, and by electing R. M. Gaylord, Ingersoll Milling Machine Co., first vice-president, C. R. Burt, Pratt & Whitney Co., second vice-president, and Geo. E. Randles, Foote-Burt Co., treasurer.

General manager Ernest F. DuBrul reported that the sales index number for machine tools had made a further gain for September and that the 3-months' moving average curve had turned upward. In his semi-annual report Mr. DuBrul had this to say on business:

"In this, the 29th year of the existence of the Association, we are going through the industry's usual third year's slump. Judging from the experiences of 1921, 1924, and 1927, demand for machine tools should now show an up-

R. M. Gaylord

ward trend. We of course cannot tell how fast this trend will increase nor how high it will go. It has been disappointing to find that the slump during this summer was worse than in 1927, but it is comforting to know that it has turned out to be better than the slump of 1924.

"The depth of this slump again shows that the higher the boom preceding, the deeper the slump following. In view of the very great height of the boom in 1928 and 1929, we are perhaps fortunate that the machine tool industry has not suffered more.

"Harking back to some very fundamental economic conditions it is worth while to repeat something which has been repeated many times before, concerning the reasons why any competitor gets whatever participation he does get out of any kind of a market.

"These reasons are as follows:

*"1st. Design.* One cannot participate in any machine tool market unless he has a machine that appeals to the user as being worth the user's money as a productive instrument. This means that his designing must be kept up-to-date. Along with design, of course, must go a recognized quality in material and workmanship. The design itself will not produce participation equivalent to another machine of comparable design but of better quality.

*"2nd. Selling Efficiency.* No matter how good a design, nor how well made the machine may be, its producer will not get as much participation in the market as will the man who is doing a better marketing job on an equal basis of design and quality. Therefore as a

C. R. Burt

reason for participation, we would place selling efficiency second to design. But all the selling efficiency in the world will not maintain participation for a machine which is inferior in design and quality if the producer of a better design or quality is equally efficient in selling.

*"3rd. Service.* Under this term we would not class only the servicing which a particular type of machine would reasonably be expected to require in the way of installation, demonstration, etc. We also class delivery under this heading. In times like the present delivery is not as strong a factor in participation as it is in boom times. Nearly every producer is able to make deliveries now as promptly as the conditions of the sale warrant.

*"4th. Good Will.* As the next factor

G. E. Randles

we would list Good Will, or as the advertising men like to call it, User Acceptance. This is built up over a period of years and cannot be won over night any more than design can be changed

over night, or than service or selling efficiency can be doubled over night. All of these four elements are matters of growth.

"The good will factor is an important influence in the amount of participation which any competitor will get out of a given market. Naturally, the new competitor who is not known to the user and who has not established a reputation for design, quality, and service is at a disadvantage. He cannot possibly get as much participation at the same price, or even at a lower price as the company which has been established for many years. He must build up a good will which will induce buyers to give him an order in preference to another competitor.

*"5th. Price.* Last and least of all the elements influencing participation we place price. It is the only element of the five which can be changed over night. It is the only one which, when changed, makes it necessary for the competitor to change promptly in order to maintain his relative participation. One of the curses of industrial management is that so many manufacturers do not realize that price is the least of the five elements. Therefore we often see price wars which result only in a reduction in the profits of business with no increase in the physical volume of goods bought.

"The wise executive will always insist on a price that will produce a reasonable, rational, sensible profit, that will enable his business not merely to exist, but to grow in service to the customer, and to produce more and better designs as experience shows they can be made and sold at a profit."

## Foundry Equipment Indices Show Rise

The index of gross orders of the Foundry Equipment Manufacturers' Association shows an increase of almost 6 per cent for September, going from 85.2 in August to 91. The three-month average, however, showed a decline from 92.6 to 90.8 because of a particularly good June. Shipments dropped from 82.6 to 66, while unfilled orders raised from 140.2 to 170.8. These figures are all on the base of average monthly shipments for 1922-23-24 taken as 100.

## Lincoln Electric Announces Arc Welding Competition

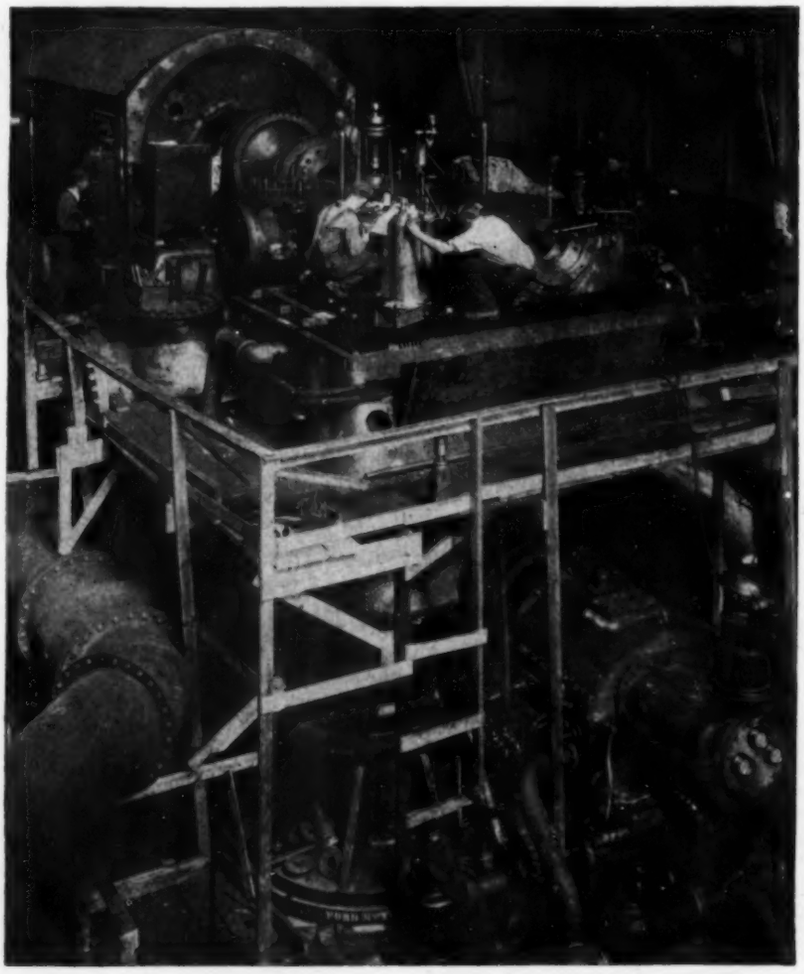
Forty-one prizes totalling $17,500 will be awarded designers and engineers in every industry for the best papers submitted in the second Lincoln Arc Welding Prize Competition sponsored by the Lincoln Electric Co. The jury of awards will be composed of the Electrical Engineering Department of Ohio State University under the chairmanship of Prof. Erwin E. Dreese, head of the department, and such others as he may select. The purpose of the Second Lincoln Prize Competition, as announced by its sponsors, is to stimulate designers and engineers to think of the manufacture of their own products by the use of arc welding and to increase their knowledge of the feasibility of its application. The competition as announced is open to any person except employees of the sponsors.

## No Power Show Planned in 1931

According to a recent announcement, the Power Show, to be held in the Grand Central Palace, New York City, Dec. 1 to 6, will be the last to be held for two years. A large variety of equipment is to be exhibited this year, including a number of units much larger in size than those ordinarily shown. Many of these exhibits will be shown under operating conditions. All phases of the power industry from first aid equipment for airplanes to material-handling equipment for boilers will be included in the display. Annual meetings of the American Society of Mechanical Engineers and American Society of Refrigerating Engineers will parallel the dates for the show.

## Iron Alloy Progress Foundation Study Subject

A fund of $230,000, to make possible a review of all available literature on the subject of progress in the field of iron alloys, has been contributed by co-operating organizations, including the American Foundrymen's Association, the Battelle Memorial Institute, and approximately 50 companies producing or using steel and iron. Universities and technical schools, foreign agencies, and bureaus of the U. S. Government are aiding the project, in which the Engineering Foundation has the active assistance of the A.I.M.E., and the American Iron & Steel Institute. The A.S.M.E., A.S.C.E., and A.I.E.E. are also co-operating. Dr. George B. Waterhouse, professor of metallurgy in the Massachusetts Institute of Technology, is chairman of the committee which will undertake the research.



**Assembling the 1,200-lb. 1,800-r.p.m. high-pressure element of the 110,000-kw., vertical-compound turbine for factory test at General Electric, before delivery to the Ford Motor Co. The double-flow, low-pressure turbine and generator are directly beneath the high-pressure unit. A previous step in assembly was pictured last week in *American Machinist***

# Lehigh University Dedicates New Packard Laboratory

REFERRING to the new James Ward Packard laboratory of Electrical and Mechanical Engineering at Lehigh University as a crucible of science from which new industries may arise, Charles M. Schwab, chairman of the board of the Bethlehem Steel Corporation, delivered the dedicatory address which featured the exercises marking the formal opening of the laboratory on Oct. 15. The building is a gift of the late James Ward Packard. A number of interesting papers were presented on the two days immediately following the dedication and the demonstration planned by S. M. Kintner, vice-president in charge of research of the Westinghouse Electric & Manufacturing Company.

Included among those who prepared papers were: Frank A. Merrick, president, Westinghouse Electric & Manufacturing Company; Lewis W. Baldwin, president, Missouri Pacific Railway; Alfred R. Glancy, president, Oakland Motor Car Company; Matthew S. Sloan, president, Brooklyn Edison Company; Bancroft Gherardi, vice-president and chief engineer, American Telephone & Telegraph Company; Dr. Arthur M. Greene, Jr., dean of the School of Engineering, Princeton University; Dr. Dugald C. Jackson, head of the Department of Electrical Engineering at Massachusetts Institute of Technology; David Ross, president of the Ross Gear Company and president of the Board of Trustees, Purdue University; Dr. William E. Wickenden, president of the Case School of Applied Science; Magnus W. Alexander, president of the National Industrial Conference Board; Dr. Edward A. Filene, president and chairman of the board, William A. Filene's Sons Company; Dr. John Johnston, director of research, United States Steel Corporation; and S. L. Andrew, chief statistician of the American Telephone & Telegraph Company.

The Packard laboratory is of native sandstone, with Indiana limestone trim. It is 234 ft. long by 170 ft. wide, the total cost being $1,200,000. The rear section, housing the main laboratory, is three stories high, while the front section is five floors high, two of them being below the ground level at the front because of the ground contour. The main laboratory is 223x63 ft., and includes two floors of these dimensions and a balcony for lighter machinery. Space in the building is divided equally between the departments of Mechanical and Electrical Engineering, each maintaining its own shop and instrument rooms, the latter being adjacent to the laboratories on all three floors. Both departments devote approximately 60 per cent of their floor space to laboratory and research work, 30 per cent to classrooms and offices, and 10 per cent to coat, study, and lounging rooms.

# Import Gains Indicate Increasing Business —Brazilian Revolt Promises Sales

PAUL WOOTON
*Washington Correspondent*

WASHINGTON, D. C., Oct. 21—Slight, very slight gains in import trade and factory payrolls indicate that business anticipates some release of buying power. The increase of $19,000,000 in one month's imports, although the reverse of the usual trend in September, must be duplicated this month before Washington will place much emphasis on this signal of better times, but it is regarded hopefully. More sensitive to industry's appraisal of future prospects, import trade is a better index than export trade, although this increased $20,000,000 last month, due to large shipments of raw cotton.

Industrial employment gained in September for the first time in a year. The number employed in the 13 industrial groups included in the Labor Department's index increased one per cent; payroll totals, 1.4 per cent. The number employed in the group embracing manufacturing industries decreased ⅓ of one per cent, continuing the decline that has not been interrupted since last March, but payroll totals increased ⅓ of one per cent. Payroll totals usually show a larger increase at this season.

Some business for manufacturers of arms and ammunition as well as aircraft manufacturers is promised by the revolution in Brazil. The federal government has purchased ten bombing planes and is reported to be in the market for ammunition.

## Industrial Engineers Meet in Washington

The Society of Industrial Engineers held its annual meeting at the Mayflower Hotel, Washington, D. C., on Oct. 15-17. Activities were divided into five parts: Breakfast "get together", morning meeting, luncheon conference, afternoon sightseeing, evening dinners and sessions.

John M. Carmody, president of the society and editor of "Factory & Industrial Management", delivered the keynote address on the topic of "Industrial America." Ray M. Hudson spoke on "Our Materials", Harold V. Coes spoke on "Our Machines", and Frances Perkins spoke on "Human Values." Subsequent meetings took up a wide variety of subjects from "The Present Status of Industrial Engineering in College Curricula" to talks by government officials regarding government aid to Industrial America, and a Harrington Emerson commemorative dinner.

## Simonds Saw Plans Windowless Building

Industry's first windowless factory building, entirely without daylight and embodying advanced ideas for the scientific creation of ideal light and other working conditions for employees, is to be constructed by the Simonds Saw & Steel Co., Fitchburg, Mass. The novel $1,500,000 structure will cover nearly two city blocks and will have solid roofs and walls. Elaborate systems will be installed for lighting, ventilation, and noise absorbtion through acoustical walls and ceilings. The contract, placing complete responsibility for design and construction, has been awarded the Austin Co., Cleveland.

Interior walls and ceilings will be blue, green, and white. The lighting system will be arranged to supply ultra-violet light. Machines will be painted orange to lift visibility and reduce accidents. Lighting will be through 1,000-watt lamps.

## Hack-Saw Frame Revision Submitted to Industry

A proposed revision to the federal specifications for hack-saw frames which will govern future government purchases of hack-saws, has been submitted to producers of this tool. Comments and criticisms from industry must be submitted by Nov. 20 if they are to receive the attention of the technical committee considering this subject.

A proposed American Standard for pipe plugs of cast iron, malleable iron, cast steel, and forged steel is now being distributed in tentative form to industry for criticism and comment. This standard has the approval of the manufacturers for use in connection with the American Standards for 125-lb. and 250-lb. cast iron screwed fittings and the American Standard for 150-lb. malleable iron screwed fittings. The material is now in tentative form for discussion and criticism. These should be addressed to C. B. LePage, Assistant Secretary of the A.S.M.E., 29 W. 39th St., New York, N. Y., from whom copies of the draft may also be obtained.

# BUSINESS ITEMS

E. C. Atkins & Co., Indianapolis, Ind., have recently made several changes in their southern organization. K. W. Atkins, who has been general manager of the southwestern territory with headquarters at Memphis, Tenn., is to be transferred to the home office as assistant sales director in the department of N. A. Gladding, first vice-president and general manager of sales. The stock of general mill supplies at Memphis has been sold to the Lewis Supply Co., of that city, though the Atkins company will continue to operate its own service station shop at 477 S. Main St. James W. Gladding, local business manager, will preside over this office. Charles S. Haggarty, who has been manager of the New Orleans Atkins branch for 20 years, has been promoted to supervisor of the saw mill and factory trade in New Orleans and Memphis territories. C. J. Hendryx, who has been Atlanta branch manager for 16 years, has been promoted to supervisor of sales of the hardware and mill supply trade in the South.

The Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich., has awarded the contract for the design and construction of a new unit for the Continental Tool Division to the Austin Co., Cleveland, Ohio. The new plant, to be erected at 5,835 Martin Ave., Detroit, is 53x190 ft., one-story steel frame construction.

The General Electric Co. will occupy Booths 230 and 231 at the Southern Textile Exposition in Greenville, S. C., Oct. 20-25. Several sets of control equipment and a new rayon motor will be shown. T. H. Reeves will be in charge.

The General Grinder Corporation, Milwaukee, has been organized to manufacture tool grinders and hardware specialties. Van B. Hooper, formerly sales manager of Master Lock Co., Milwaukee, heads the new concern, being established at 250 Milwaukee St.

The Chevrolet Motor Co., a division of the General Motors Corporation, has purchased the Indianapolis plant of the Martin-Parry Corporation, and will assume control at once, to begin production of Chevrolet commercial bodies. J. A. Jamieson, Chevrolet controller, will be general manager. The sale includes some 25 assembly plants, which General Motors will increase to 50. The Martin-Parry Corporation will continue in business, with plants at York, Pa., and South Kearney, N. J.

The Canada Wire & Cable Co., Ltd., has begun work on its rod mill and wire-drawing plant in Montreal East, Ont., adjacent to the refinery of Canadian Copper Refiners, Ltd.

The Truscon Steel Co., Youngstown, Ohio, is building a $150,000 warehouse and fabricating plant at Carroll Ave. & Newhall St., San Francisco, to act as distribution unit for northern California.

The Micromatic Hone Corporation, Horton & Dubois Sts., Detroit, Mich., known as the Jeschke Tool Corporation until Sept., 1929, has occupied its new building.

The Arundel Corporation, Fairfield, Baltimore, Md., has begun to rebuild its ship repair shops destroyed by fire recently.

# PERSONALS

Edward Blake, formerly vice-president of the Greenfield Tap & Die Corporation, has been made general manager of the Trimont Manufacturing Co., Roxbury, Mass.

B. L. Donahue has been appointed manager of the Buffalo district office of Cutler-Hammer, Inc., Milwaukee, Wis., to succeed B. A. Hansen, resigned. Mr. Donahue has been connected with the Pittsburgh branch office for the past eight years.

Joseph E. Doyle, vice-president of the W. S. Rockwell Co., spoke on "Practical Heat Treatment" at a recent meeting of the Lehigh Valley chapter of the A.S.S.T. The speaker stressed uniformity possible only with individual treatment by saying "You can't bake six hot cakes on the same grid and have them all alike."

J. R. Adams, superintendent of special products of the Midvale Co., Nicetown, Pa., delivered an illustrated lecture on "Forging" recently before the St. Louis chapter of the A.S.S.T.

H. C. Edwards of the Packard Motor Car Co., will speak on "Development of the Packard-Diesel Airplane Motor" on Oct. 24 at a meeting of the St. Louis Section, A.S.M.E. His talk will be illustrated by motion pictures and slides. Mr. Edwards is the Diesel research engineer for the Packard company.

Benno Elkan, executive vice-president of the International Minerals & Metals Corporation, New York, has been elected a member of the National Metal exchange.

F. L. Holmes, president of the North & Judd Manufacturing Co., New Britain, Conn., has been elected treasurer to succeed the late Samuel McClutcheon. F. L. Morrow has been appointed assistant secretary.

Daniel C. Jackling, president of the Utah Copper Co., will be presented the William Saunders medal of the A.I.M.E. at a dinner on Oct. 31. President Hoover received the medal in 1928, and John Hays Hammond received it in 1929.

Fred E. Kling, chief engineer in the Youngstown district for the Carnegie Steel Co., has been appointed chief engineer of all Carnegie plants, with headquarters in Pittsburgh.

B. H. Johnson has been elected president of the Gray Iron Institute. Mr. Johnson is associated with the Florence (N. J.) Pipe Foundry & Machine Co.

T. H. Maclaren, who for several years was sales manager for Cunningham & Hill, Ltd., Toronto, Ont., has been appointed general sales manager for the Galt Brass Co., with headquarters at the Toronto office, 85 Adelaide St., West. Mr. Maclaren was formerly assistant sales manager and buyer.

B. L. Mills, sales manager of the Bastian-Blessing Co., Chicago, was recently elected president of the Gas Products Association. This is the first time in the history of the 12-year old organization that anyone beside a manufacturer of oxygen gas has been elected president. A. J. Fausek of the Modern Engineering Co., and W. H. Ballance of the Electrox Co., were chosen first and second vice-presidents.

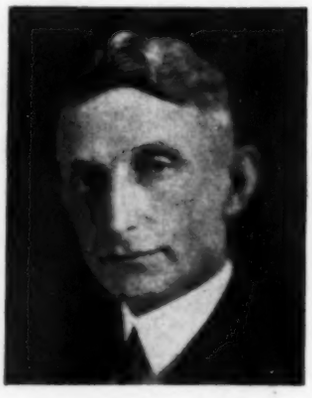
Leo Murphy, of Montreal, has been appointed inspector of boilers and machinery and of hulls and equipment of steamships at the port of Montreal, to succeed the late Stanley Gruzelier.

The C. F. Myers Manufacturing Co., 119 East York St., Baltimore, Md., has established a plant to conduct a general line of machine work. C. F. Myers is owner.

N. A. V. Paulsson, formerly assistant general manager of the Ludlum Steel Co., Watervliet, N. Y., has resigned to become general superintendent of the plant of the Avesta Iron & Steel Works, Avesta, Sweden.

Delmar G. Roos, chief engineer of the Studebaker Corporation of America, spoke on "Free Wheeling" at the Oct. 16 dinner meeting of the Metropolitan Section of the S.A.E.

Thomas R. Weymouth has resigned as chairman of the board of the Oklahoma Natural Gas Corporation to become vice-president of the Columbia Engi-



neering & Management Corporation, New York. Mr. Weymouth was recently elected a vice-president of the American Society of Mechanical Engineers.

I. J. Reuter, vice-president of the General Motors Corporation and managing director of Adam Opel A.G., Rus-

selsheim, Germany, has been appointed general manager of the Oakland Motor Car Division, Pontiac, Mich., to succeed A. R. Glancy, vice-president, transferred to the general staff, Detroit.

R. A. Schoenfeld has been appointed sales engineer with headquarters in the Chicago district offices of the Hevi Duty Electric Co., Milwaukee, Wis. Mr. Schoenfeld has been for the last seven years sales manager of the Claud S. Gordon Co., Chicago.

A. M. Sheldon, vice-president and general manager since 1926 of the Union Special Machine Co., 400 North Franklin St., Chicago, has been elected president to succeed the late Parker S. North.

C. A. Thayer has been appointed vice-president in charge of operations of the Republic Steel Corporation, Youngstown, Ohio, with headquarters at Youngstown. Mr. Thayer's most recent connection was with Arthur G. McKee & Co., as chief engineer for that company's steel works project in Russia.

L. E. L. Thomas, vice-president of the Freyn Engineering Co., Chicago, returned recently from Soviet Russia where he has been for the past 18 months in connection with iron and steel consulting services being rendered the Soviet Government by his company. Mr. Thomas will return to Leningrad early in November.

John Tirrell, general foreman of the Warren Foundry & Pipe Co., Phillipsburg, N. J., spoke on "Casting the Largest Pipes That Ever Have Been Made" on Oct. 22 at a meeting of the Metropolitan Section of A.S.M.E.

Stanley M. Tracy, treasurer of the Driver-Harris Co., Harrison, N. J., was tendered a dinner on Oct. 9 by his associates in celebration of his 20 years' service with the company. He started as office manager of the American Wire Cloth Co., a subsidiary, and was elected treasurer and director in 1922 and in 1929 he also became director of the British Driver-Harris Co.

W. E. Van Dreser, formerly Minnesota and Wisconsin representative of the Hollup Co., Chicago, has been elected vice-president in charge of the eastern district. His headquarters will be at the Brooklyn, N. Y., plant, 269 Thirty-Seventh St. C. L. Jones, formerly Brooklyn plant manager, has been placed in charge of the southeastern district, with headquarters at Atlanta, Ga.

G. B. Warren of the turbine engineering dept., General Electric Co., Schenectady, will summarize a selected group of papers presented at the Second International Engineering Congress on Oct. 22 at a meeting of the Schenectady local section of the A.S.M.E.

E. A. Wilcox has been appointed California representative of the Hoskins Manufacturing Co., Detroit, Mich. Mr. Wilcox address will be 273 Seventh St., San Francisco.

# OBITUARIES

Carl A. Meissner, 71, steel mill engineer, and for 25 years, until his retirement in 1929, chairman of the principal operating committees of the United States Steel Corporation, died Oct. 13.

George W. Caldwell, 70, former mayor of Columbus, Ind., and head of several companies, died recently at his home in Indianapolis. He was head of the Caldwell & Drake Iron Works, Caldwell & Drake, the Caldwell Manufacturing Co., and the National Machine Co., all of Columbus.

Edward L. Schneider, 59, superintendent of the switch department, Crouse-Hinds Co., Syracuse, N. Y., and the first man to be hired by the company when it began operations in 1897, died suddenly of heart disease on Oct. 13.

Harding Allen, 63, pioneer manufacturer and banker of Barre, Mass., and owner of the Chas. G. Allen Co. of that

city, died on Oct. 11 in Barre after a short illness. His present company was built up from a small business purchased from his father's estate in 1896. His outstanding contribution was the Allen ball bearing sensitive drill.

Leander S. Heald, 94, father of James N. Heald, president of the Heald Machine Co., died on Oct. 12 at his home in Worcester, Mass., after a long illness. Leander Heald was until 1903

head of the L. S. Heald & Son Machine Shop at Barre, Mass., when he sold out to his son, who moved the business to Worcester. Leander succeeded to the presidency of the original company, formed in 1826 by his father, Stephen, upon the latter's retirement.

Charles A. Mudge, 59, general manager of the Electrodynamic Co., Bayonne, N. J., died on Oct. 13.

H. Thomas Oliver, 46, general superintendent of the National Equipment Co., Springfield, Mass., died on Oct. 13 in that city after a brief illness. Before going to that concern last year he was production engineer for the Henry Moss Co., Brooklyn, N. Y.

Frank L. Van Epps, Sr., president of the Freeland Steel Tank Co., Portage, Wis., died on Oct. 2 from a heart attack

Albert W. Walburn, 78, retired machinery manufacturer, died on Oct. 15 at his home in Elmsford, N. Y. He had been retired for 20 years, but was at one time head of the Walburn Swenson Co., later absorbed by the American Round Bale Co.

# FORTHCOMING MEETINGS

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Calvin W. Rice, executive secretary, Engineering Societies Bldg., 29 West 39th St., New York, N. Y. The following meetings are scheduled:

Fifty-first annual meeting, Engineering Societies Bldg., Dec. 1-5.

Semi-Annual meeting, Birmingham, Ala., Apr. 20-23, 1931.

National Materials Handling Meeting and Management congress, Cleveland, Ohio, Apr., 1931.

National Aeronautic Meeting, Baltimore, Md., May, 1931.

STEEL FOUNDERS' SOCIETY OF AMERICA—October meeting at Pennsylvania Hotel, New York City, on Oct. 23, the day preceding the New York meeting of the American Iron & Steel Institute. G. P. Rogers, 932 Graybar Bldg., New York City, is managing director.

AMERICAN IRON & STEEL INSTITUTE—Semi-annual meeting, Hotel Commodore, New York, N. Y., Oct. 24. E. A. S. Clarke, secretary, 75 West St., New York, N. Y.

NINTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING—In Grand Central Palace, New York City, Dec. 1-6. Charles F. Roth, manager. Grand Central Palace.

WESTERN METAL CONGRESS AND EXPOSITION—Second National, Civic Auditorium, San Francisco, Calif., Feb. 16-20, 1931. Under auspices of A.S.S.T. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

# THE INDUSTRIAL REVIEW

## Weekly progress of the machinery and machine-tool business

### CINCINNATI

Machine-tool manufacturers of the Cincinnati district had a fairly-balanced business ration the past week, but it was by no means large enough to be satisfying. The best that can be said of the market is that it did not grow any more sluggish. Business received was largely made up of single orders, well diversified and coming from all sections of the country.

Selling agents state that most of the business booked by them in the week was the result of the purchaser having a sudden need for a tool for work taken on, there being little buying against long-standing inquiries. A fair volume of inquiries were received by both branches of the trade, the greater part being for single tools. As a rule, the buying is predicated on the business of the prospect getting better. Therefore, inquiries are not at this time regarded as a reliable indicator of the immediate future.

### DETROIT

October has been a dull period in the machinery and machine-tool trade. The last ten days have been particularly quiet. There are some indications of an early improvement, but most of the representative dealers believe the upward movement will not begin before December or January.

During the last ten days the market has become depressed and it is doubtful now whether October will be as good a month as September. One large dealer has reported the receipt of important inquiries for replacement machinery to be used in a tool shop, a few good-sized orders have been received for general equipment, and some specialized machines have been sold.

### NEW YORK

One New York dealer, at least, finds some cheer in the present situation, having received an order for 9 tools, including an 18-in. lathe, a cold saw, drills, and a grinder. Other orders are trickling in singly, most of them in lesser volume than the preceding week. Dealers consider Wall Street one of the biggest factors in darkening a situation that was beginning to look very good. The ground lost by Wall Street's slide must now be regained, and this may mean several weeks of effort. There are vague rumors of price cuts by some dealers who find bills mounting, but in the main the situation is as cheerful as can be expected. Inquiries are showing some gain, but are about 50-50, half of them being for current orders, the remainder for cataloging.

The B & O railroad has authorized a $4,000,000 car-building program, providing 60,000 to 70,000 man-days of work building the 2,000 cars at the Baltimore plant. The Chicago Great Western has ordered 500 steel box cars, and the Santa Fe 370 miles of rails.

### PHILADELPHIA

Purchase of eight radials by the Baldwin Locomotive Works was the high spot in the machinery and machine-tool business in the Philadelphia area during the last two weeks.

There was little change noted in the trade from other sources and leaders of the industry saw little indication of a marked improvement soon. Conditions in the radio industry were unchanged from the last fortnight. One plant actively engaged in the production of aircraft, however, reported a busy period, with prospects for a few weeks' continued activity. In other lines, sales of any considerable size were lacking, with little indication that there will be activity from the railroads or automotive industry in the near future.

■

**BEAR tactics in Wall Street, which have succeeded in scattering much of the optimism which was evident there several weeks ago, seem also to have taken their toll in the machinery and machine-tool markets. At least, that is the only reason offered for the sudden slowing of the upturn which was beginning to make itself felt. The result, however, has been an aggravation of the spottiness which has made itself evident during the past several weeks. Reports of 8- to 10-tool orders in some markets are contrasted with reports of single-tool orders and few of them in others. Manufacturers and dealers, co-operating much better than they have for years, find themselves met with decisions to wait until "something turns up." Just exactly what will turn up is extremely obscure, but purchasers seemingly fail to realize that deliveries are better than good and that the next movement of the price index will be up—not down.**

**CINCINNATI buying was for single tools for immediate need. Inquiries there, as in most other sections, are no indication of possible purchases because of the number of inquiries for catalog purposes only—or predicated on a business upturn. Detroit reports sales of some specialized tools, but a quieter condition of the market generally. New York has some railroad building, but few machine orders beyond one for 9 tools. Philadelphia markets are quiet, with the exception of Baldwin Locomotive's purchase of 8 radial drills for replacement. New England small tool sales are steady, others slow, though business looks more cheerful. Buffalo reports some industries "going great guns," others quiet. Milwaukee reports some Detroit orders for special tools, while Chicago and Los Angeles place their hopes on inquiries received.**

### NEW ENGLAND

A spark plug or something else is needed in the New England section to get things started. The current week was "just another week." Orders were few; and, while prospects in the total are representative of a varied demand from scattered sources, buyers do not display a willingness to close. Small tool sales are steady.

Industrial gains are responsible for an improved business sentiment. A distinctly favorable turn showed in the typewriter manufacturing field, one company adopting a ten-hour-a-day schedule.

Executives in the machinery field regard the anticipated demand sufficiently promising to restore a substantial level of business, once buying starts.

### BUFFALO

The status quo of business expectation indicated in the last two reports is still maintained, but actual orders are as yet not so plentiful as inquiries of a month ago seemed to indicate. There is real belief in some offices of machine-tool and electrical equipment dealers that orders will materialize, not in a shower, but in gradually increasing volume during the next few weeks.

Salesmen report that increased business in Buffalo and western New York industries is by no means universal. There are some industries, however, which are "going great guns," notably the Worthington Pump & Machinery Corporation, which has been working overtime for several weeks at its Buffalo plant.

Contractors' equipment demand is low.

### MILWAUKEE

Although the first part of October showed encouragement in an improvement of inquiries and orders, reports from the local machinery and machine-tool builders and dealers now indicate that the month will not come up to expectations. Inquiries are fair, but many orders are apparently being held up by the powers that be, after being sent up by the purchasing department for financial O. K. Business being placed is mainly for single tools going to a diversified line of general machinists and miscellaneous industries using small tools such as drills and taps. Small-tool manufacturers have been in the market this month for small lots of cutters, reamers, and similar equipment.

Machine-tool manufacturers report small orders for special equipment coming from Detroit automotive manufacturers. There has also been an improvement in inquiries and a few small orders from railroads, but agricultural and electrical equipment industries are out of the market.

### CHICAGO

Business in machine tools, with few exceptions, is reported to have reached probably the lowest level of the year. Manufacturers' representatives, selling agents, and distributors of standard lines of tools and machinery are in general agreement that, while an upward turn is not looked for in the immediate future, the closing months of 1930 will see some improvement, and that during the first quarter of 1931 industrial production will have started on its way toward normalcy. This optimistic outlook is founded on the fact that while bookings at this time are lamentably few, inquiries show little if any diminution, and that eventually trade will reach a fairly satisfactory volume. No sales of any importance are noted, either for new or used tools, aside from those received and still coming in from the Chicago Board of Education.

### LOS ANGELES

With the final quarter of the year under way, it cannot be said that any marked or appreciable change has become apparent in the industrial and machine-tool situation in this district. A general consensus of opinion among dealers would indicate that a healthier tone obtains in respect particularly to number and quality of inquiries. The anticipated increase in volume of business looked for, for example, as a result of the extension of activities in oil field drilling operations, is in the main a feature yet to be realized upon. In other words, as a rule, the oil tool and equipment shops have not been forced to any appreciable expansion of their manufacturing facilities recently in order to take care of field requirements.

# BUSINESS • BAROMETER

## *A distinct improvement in trade indicated after the November elections*

**THEODORE H. PRICE**
*Editor, Commerce and Finance, New York*

ELECTION DAY will soon be here, and the political orators are busy. It is doubtful whether their speeches change many votes, but they have been effective in advertising the business depression from which we are emerging. The Democrats hold the Republicans responsible for the panic on the Stock Exchange, while the Republicans insist that there would have been no serious decline in the markets if the passage of the tariff bill had not been delayed by their opponents. The controversy will never be settled, but there is no doubt that the debate has caused what might be called a secondary decline in stocks, and that the improvement in commodity values that was commencing to manifest itself has been temporarily checked.

But as this is written optimism is reviving, and both stocks and staple products are again holding up their heads. Short selling on the Stock Exchange is rapidly becoming taboo. Those who are short find it difficult to borrow the securities that they need to make deliveries, and commodity prices are so low that there are but few who are willing to sell short now that sentiment seems to have changed.

The advance in bonds which was induced by low interest rates seems to have been halted, and a slight tightening in the very easy money market is expected between now and New Year's. For this reason it would seem wise for those who need credit to provide themselves with the money that they are likely to require during the next three or four months.

The commodity markets have been relatively quiet, but they show much less nervousness, and sugar has had what might be called a sensational advance as it is up more than thirty points or 33 per cent during the last two weeks. The improvement is largely due to the activities of the committee of which Thomas L. Chadbourne is chairman. He has devised a plan, to which Cuba is expected to assent, for withdrawing 1,500,000 tons of raw sugar from the American market, and is sponsoring a proposal to impose a limit of 2,800,000 tons upon the exports from Cuba to the United States in 1931.

The inability of the London Conference to agree upon a protective tariff for the British Empire is an important item in the week's news. The British Government, while rejecting the tariff proposals made by the Dominions and standing by its so-called free-trade principles, has adopted the one-time Conservative proposal to buy a large specified quota of the country's foodstuffs and industrial materials from the Dominions. Otherwise, Great Britain will continue as heretofore to buy in the cheapest market and to sell where she can get the best prices.

### THE BUSINESS WEEK

*October 22, 1930*

**BUSINESS is bearing up as well as can be expected under the weight of the wave of uncontrolled deflation which financial fatalism and lack of business statesmanship in this country let loose upon the world in the third quarter. . . . There is a marked shortage of bear food in this week's crop of statistics, and signs multiply indicating that business as a whole is not getting worse and is making definite improvement—too slow to warrant any high hopes of quick recovery this year, but steady enough to justify those looking and planning ahead for next year. . . . Our index has risen again, for the fifth consecutive week, from 87.1% to 87.5% of normal, reflecting chiefly continued expansion in general trade and a level of building sustained above seasonal expectations. . . . Increased consumption of electric power in manufacturing during September with some gain in employment and payrolls, indicate a fair seasonal resumption of industrial activity. . . . A further rise in foreign trade in September, with record exports of cotton, offers some encouragement in face of increased uncertainties abroad. . . . Sharply rising orders for machine tools for the second consecutive month shows that some industries, at least, think these States still have a future, and are unwilling to join the procession of economic crustaceans who are trying to teach the country to walk backward. . . . Bears can be—and are being—tamed, but what can be done with the crabs?**

©The Business Week

The cotton market has advanced slightly, and is showing a distinctly better tone. The Federal Farm Board has again announced that the cotton it now holds will not be sold until cost and carrying charges can be obtained for it. This means that it will be held for 17 or 18 cents a pound, and an ingenious economist is urging that it shall be kept permanently and financed by the issuance of a loan to be secured by the hypothecation of the cotton owned. It is alleged that such a loan could be financed at under 2 per cent, and that it could be extended indefinitely, or at least until its sale at a profit became practicable. This proposal carries one back to the days of the Civil War.

The steel industry maintains its recent rate of operations though its customers are buying mostly from hand-to-mouth. A better demand for structural steel is reported. From this it is inferred that building activity is holding up a little better than usual at this season. This deduction seems to be confirmed by most private and official reports. The automobile industry is the principal laggard, and its production is still falling off. But early introduction of new models is expected to help fourth-quarter sales. At ten cents a pound and slightly below, an enormous demand for copper has been developed, and it begins to look as if the low prices at which essential staples have been selling furnish the foundation for a year of very prosperous business. Foreign trade showed the usual seasonal increase in September, and factory employment and payrolls gained during the month.

The political situation in South America is not re-assuring, but it is hard to obtain reliable information of what is going on, and many who are well-informed doubt the seriousness of the well-advertised revolutions that are reported in several South American countries.

Things seem to be relatively tranquil in Europe, and more peaceful in Asia. A distinct improvement in American trade after the election appears to be indicated.

Car loadings are still running behind last year, but they are catching up, and in 1931 we ought to see a crescendo movement toward prosperity, irrespective of whether the Republicans or the Democrats win at the coming election.

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# THE WEEKLY PRICE GUIDE . . . .

### *Rise and Fall of the Market*

A SUFFICIENTLY large volume of steel buying by railroads, pipe lines, ship-building and construction industries is in evidence, to support the price on the principal hot-rolled materials at $1.60 per 100 lb., base, Pittsburgh. In another month, perhaps, all concessions under this base will have disappeared. In nonferrous materials, copper remains quiet, while zinc has touched a new low since 1902, at which time it was sold for 3.87½c. per lb., E. St. Louis, against the present price of 3.95c. Sentiment appears better in tin and lead, although tin recently declined. This week's transactions saw further slump in prices of babbitt metal, solder, fabricated brass and copper products.

(*All prices as of Oct.* 17, 1930)

## IRON AND STEEL

**PIG IRON**—Per gross ton, f.o.b.:

| | |
|---|---|
| CINCINNATI | |
| No. 2 Southern (silicon 1.75@2.25) | $16.69@$18.19 |
| Northern Basic | 19.89@ 20.39 |
| Southern Ohio No. 2 | 19.89@ 20.39 |
| NEW YORK—Tidewater Delivery | |
| No. 2 Southern (silicon 1.75@2.25) | 18.00@ 18.50 |
| BIRMINGHAM | |
| No. 2 Foundry (silicon 1.75@2.25) | 14.00 |
| PHILADELPHIA | |
| Eastern Pa., No. 2x (silicon 2.25@2.75) | 20.00 |
| Virginia No. 2 | 18.75@ 19.25 |
| Basic | 22.29 |
| CHICAGO | |
| No. 2 Foundry, local (silicon 1.75@2.25) | 19.00 |
| No. 2 Foundry, Southern (silicon 1.75@2.25) | 18.20 |
| PITTSBURGH, including freight charge ($1.76) from Valley: | |
| No. 2 Foundry | 19.63@ 20.13 |
| Basic | 19.63@ 20.13 |
| Bessemer | 20.76 |

**IRON MACHINERY CASTINGS**—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

| | |
|---|---|
| Detroit | 4.00 |
| Cleveland | 4.75 |
| Cincinnati | 4.50 |
| New York | 4 75@5.00 |
| Chicago | 4.50@4.75 |

**SHEETS**—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

| Blue Annealed* | Pittsburgh Mill Base | Chicago | Cleveland | New York |
|---|---|---|---|---|
| No. 10 | 1.90@2.00 | 3.35† | 3.00 | 3.40† |
| No. 12 | 1.95@2.05 | 3.45† | 3.10 | 3.45† |
| No. 14 | 2.05@2.15 | 3.55† | 3.20 | 3.50† |
| No. 16 | 2.15@2.25 | 3.65† | 3.30 | 3.60† |
| Black | | | | |
| Nos. 18 to 20 | 2.25 | 3.60† | 3.40 | 3.70 |
| No. 22 | 2.40 | 3.75† | 3.55 | 3.85 |
| No. 24 | 2.45 | 3.80† | 3.60 | 3.90 |
| No. 26 | 2.55 | 3.90† | 3.70 | 4.00 |
| No. 28 | 2.70 | 4.05† | 3.85 | 4.15 |
| Galvanized | | | | |
| No. 10 | 2.30@2.40 | 3.65† | 3.65 | 3.55 |
| Nos. 12 to 14 | 2.40@2.50 | 3.75† | 3.75 | 3.65 |
| No. 16 | 2.50@2.60 | 3.85† | 3.85 | 3.75 |
| No. 18 | 2.65@2.75 | 4.00† | 4.00 | 3.90 |
| No. 20 | 2.80@2.90 | 4.15† | 4.15 | 4.05 |
| No. 22 | 2.85@2.95 | 4.20† | 4.20 | 4.10 |
| No. 24 | 3.00@3.10 | 4.35† | 4.35 | 4.25 |
| No. 26 | 3.25@3.35 | 4.60† | 4.60 | 4.50 |
| No. 28 | 3.50@3.60 | 4.85† | 4.85 | 4.75 |

*Light Plates. †400 to 3,999 lb.

**WELDED STEEL PIPE**—Warehouse discounts are as follows:

| | New York Black | New York Galv. | Cleveland Black | Cleveland Galv. | Chicago Black | Chicago Galv. |
|---|---|---|---|---|---|---|
| 1 to 3 in. butt.. | 56.14% | 43.6% | 53.3% | 42.3% | 57.3% | 44.8% |
| 3½ to 6 in. lap.. | 52.72% | 40.18% | 50.8% | 37.8% | 53.9% | 41.4% |

WROUGHT-STEEL PIPE LIST

| Size, Inches | List Price per Foot | Diameter in Inches—External | Diameter in Inches—Internal | Thickness Inches |
|---|---|---|---|---|
| 1 | $0.17 | 1.315 | 1.049 | .133 |
| 1¼ | .23 | 1.66 | 1.38 | .14 |
| 1½ | .27½ | 1.9 | 1.61 | .145 |
| 2 | .37 | 2.375 | 2.067 | .154 |
| 2½ | .58½ | 2.875 | 2.469 | .203 |
| 3 | .76½ | 3.5 | 3.068 | .216 |
| 3½ | .92 | 4.0 | 3.548 | .226 |
| 4 | 1.09 | 4.5 | 4.026 | .237 |
| 5 | 1.48 | 5.563 | 5.047 | .258 |
| 6 | 1.92 | 6.625 | 6.065 | .28 |
| 8 | 2.50 | 8.625 | 8.071 | .277 |

**SEAMLESS STEEL TUBING**—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

| Thickness—Decimal | B.w.g. and Fractions | Outside Diameter in Inches—¼ | ⅜ | ½ | ⅝ | ¾ | 1 | 1⅛ | 1¼ |
|---|---|---|---|---|---|---|---|---|---|
| | | Price per Foot— | | | | | | | |
| .035" | 20 | $0.15 | $0.16 | $0.17 | $0.18 | $0.19 | $0.21 | $0.23 | |
| .049" | 18 | .17 | .18 | .19 | .20 | .21 | .23 | .25 | |
| .065" | 16 | .19 | .20 | .21 | .22 | .23 | .25 | .27 | |
| .083" | 14 | .20 | .22 | .23 | .24 | .25 | .27 | .29 | |
| .095" | 13 | .21 | .23 | .25 | .26 | .27 | .29 | .31 | |
| .109" | 12 | .22 | .24 | .26 | .27 | .28 | .30 | .32 | |
| .120" or | | | | | | | | | |
| .125" | 11 | .23 | .25 | .27 | .28 | .29 | .31 | .33 | |
| .134" | 10 | .24 | .26 | .28 | .29 | .30 | .32 | .34 | |

**MISCELLANEOUS**—Warehouse base prices in cents per lb.:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Spring steel, light* | 4.50 | 4.65 | 4.65 |
| Spring steel, heavier | 4.00 | 4.00 | 4.00 |
| Coppered Bessemer rods | 7.00 | 6.00 | 6.15 |
| Hoop steel | 3.75† | 4.00 | 3.75† |
| Cold rolled strip steel | 4.95 | 6.00 | 6.10 |
| Floor plates | 4.85† | 5.30 | 5.00† |
| Cold fin., round or hexagon‡ | 3.40 | 3.65 | 3.35 |
| Cold fin,, flat or square‡ | 3.90 | 4.15 | 3.85 |
| Structural shapes | 3.10† | 3.00 | 3.00† |
| Soft steel bars | 3.10† | 3.00 | 3.00† |
| Soft steel bar shapes | 3.10† | 3.00 | 3.00† |
| Soft steel bands | 3.40† | 3.65 | 3.20† |
| Tank plates | 3.10† | 3.00 | 3.00† |
| Bar iron (2.75 at mill) | 3.24 | 3.00 | 3.00 |
| Drill rod (from list) | 60% | 55% | 50% |

*Flat, 3/16-in. thick by ¾-in. wide. †400 to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse—5/32, 8.35c. per lb.; ⅛, 7.85c. per lb.; 5/32 to ½, 7.35c. per lb.

## METALS

Warehouse Delivery Prices in Cents Per Lb. for Small Lots:

| | | | |
|---|---|---|---|
| Copper, electrolytic, New York | | | 11.50 |
| Tin, Straits, pigs, New York | | | 27.50@28.50 |
| Lead, pigs, E. St. Louis | 4.95 | New York | 6.00@ 7.00 |
| Zinc, slabs, E. St. Louis | 3.95 | New York | 6.00@ 7.00 |

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Antimony, slabs | 10.00@10.50 | 11.00 | 10.75 |
| Copper sheets* | 20.25 | 19.35 | 19.35 |
| Copper wire* | 11.75 | 11.87½ | 11.87½ |
| Copper, drawn, round* | 18.75 | 18.25 | 18.25 |
| Copper tubing* | 22.50 | 22.00 | 22.00 |
| Brass sheets, high* | 17.37½ | 17.00 | 17.00 |
| Brass tubing, high* | 22.25 | 21.87½ | 21.87½ |
| Brass rods, high* | 15.62½ | 15.25 | 15.25 |
| Brass wire, high* | 17.50 | 17.50 | 17.50 |

*Mill, base.

# SHOP MATERIALS AND SUPPLIES

## METALS—Continued

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Aluminum ingots, 99%† | 24.00@25.00 | 24.30 | 23.30 |
| Zinc sheets (casks) | 9.75@10.25 | 11.25 | 10.11 |
| Solder (½ and ½) | 22.75 | 21.50 | 22@24 |
| Babbitt metal, delivered in case lots, New York, cents per lb.: | | | |
| Genuine, highest grade | | | 46.00 |
| Commercial genuine, intermediate grade | | | 33.00 |
| Anti-friction metal, general service | | | 30.00 |
| No. 4 babbitt, f.o.b. | | | 10.00 |

†F.O.B.

**NICKEL AND MONEL METAL**—Price in cents per lb., base, f.o.b. Huntington, W. Va.:

| | Nickel | Monel Metal |
|---|---|---|
| Sheets, full finished | 52.00 | 42.00 |
| Sheets, cold rolled | 60.00 | 50.00 |
| Strip, cold rolled | 55.00 | 45.00 |
| Rods, hot rolled | 45.00 | 35.00 |
| Rods, cold drawn | 50.00 | 40.00 |
| Tubing | 75.00* | 90.00† |
| Angles, hot rolled | 50.00 | 40.00 |
| Plates | 52.00 | 42.00 |

*Seamless. †Welded.

**OLD METALS**—Dealers' purchasing prices in cents per pound, f.o.b. cars:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Crucible copper | 8.25 @8.50 | 8.75 | 8.00@ 8.50 |
| Copper, heavy, and wire | 7.50 @7.75 | 8.25 | 7.50@ 8.00 |
| Copper, light, and bottoms | 6.75 @7.00 | 7.25 | 6.75@ 7.25 |
| Heavy lead | 4.00 | 4.00 | 3.25@ 3.75 |
| Tea lead | 2.00 | 2.50 | 2.25@ 2.75 |
| Brass, heavy, yellow | 4.50 @4.75 | 4.75 | 4.50@ 5.00 |
| Brass, heavy, red | 7.25 @7.50 | 8.00 | 6.75@ 7.25 |
| Brass, light | 3.50 @3.75 | 3.75 | 4.00@ 4.50 |
| No. 1 rod-brass turnings | 5.25 @5.50 | 5.25 | 4.50@ 5.00 |
| Zinc | 2.00 | 1.50 | 1.50@ 1.75 |

**TIN PLATES**—Charcoal—Bright—Per box:

| "AAA" Grade: | New York | Cleveland | Chicago |
|---|---|---|---|
| IC, 14x20 | $12.10 | $11.95 | $11.50 |
| "A" Grade: | | | |
| IC, 14x20 | 9.70 | 9.90 | 9.50 |
| Coke Plates—Primes—Per box: | | | |
| 100-lb., 14x20 | 6.45 | 6.10 | 7.00 |
| Terne Plates—8-lb. Coating—Small lots—Per box: | | | |
| IC, 14x20 | 7.75@8.00 | 7.00 | 7.50 |

## MISCELLANEOUS

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Cotton waste, white, per lb. | $0.13 | $0.16 | $0.15 |
| Cotton waste, colored, per lb. | .09½ | .12 | .10 |
| Wiping cloths, washed, white, per lb. | .14 | 38.00 per M | .14½ |
| Sal soda, per lb. | .01¾ | .02 | .02 |
| Roll sulphur, per lb. | .028 | .03 | .04 |
| Linseed oil, raw, in 1 to 4 bbl. lots, per lb. | .104 | .125 | .108 |
| Cutting oil, about 25% lard, in 5 gal. cans, per gal. | .65 | .60 | .60 |
| Machine oil, medium-bodied (55 gal. steel bbl.) per gal. | .33 | .36 | .24 |
| Belting—Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber: | | | |
| Leather—List price, 24c. per lin.ft., per inch of width, for single ply: | | | |
| Medium grade | 30–10% | 30–10% | 35% |
| Med. grade, heavy wgt. | 30% | 30 –5% | 30% |
| Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.: | | | |
| First grade | 60% | 50–10% | 50% |
| Second grade | 60–5% | 60– 5% | 50–10% |

## *Comparative Warehouse Prices*

| New York | Unit | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|---|
| Soft steel bars | per lb. | $0.031 | $0.031 | $0.0325 |
| Cold fin. shafting | per lb. | .034 | .034 | .036 |
| Brass rods | per lb. | .1562½ | .1587½ | .2125 |
| Solder (½ and ½) | per lb. | .2275 | .245 | .32 |
| Cotton waste, white | per lb. | .13 | .13 | .13 |
| Disks, aluminum oxide mineral, cloth, No. 1 6-in. dia. | per 100 | 4.59 | 4.59 | 4.60 |
| Lard cutting oil | per gal. | .65 | .65 | .75 |
| Machine oil | per gal. | .33 | .33 | .33 |
| Belting, leather, medium | off list | 30–10% | 30–10% | 30–10% |
| Machine bolts, up to 1x30 in., full kegs | off list | 65%* | 65%* | 50–10%* |

*List prices as of April 1, 1927

## MISCELLANEOUS—Continued

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets: | | | |
| Flint paper* | $6.03 | $6.03 | $6.03 |
| Emery cloth* | 25.87 | 25.87 | 25.87 |
| Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100: | | | |
| Paper† | 2.61 | 2.61 | 2.61 |
| Cloth† | 4.59 | 4.59 | 4.59 |
| Fire clay, per 100 lb. bag | 1.00 | .75 | .75 |
| Coke, prompt furnace, per net ton | Connellsville, | | 2.60 |
| Coke, prompt foundry, per net ton | Connellsville, | | 3.50@4.85 |
| White lead, dry | 100 lb. kegs | New York, | 13.75 |
| White lead, in oil | 100 lb. kegs | New York, | 13.75 |
| Red lead, dry | 100 lb. kegs | New York, | 13.75 |
| Red lead, in oil | 100 lb. kegs | New York, | 15.25 |

*Less than 3 reams. †Less than 200.

## SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

| | |
|---|---|
| Machine bolts: | |
| Up to ¾-in. x 6-in., full kegs, list less | 65% |
| Larger, up to 1 x 30-in., full kegs, list less | 65% |
| Less than full kegs or case lots, add to list | 10% |
| Fitting-up bolts: list less | 45% |
| Lag screws: | |
| Up to ½-in. x 6-in., list less | 65% |
| Larger, list less | 65% |
| Less than full keg or case lots, add to list | 10% |
| Rivets: | |
| Structural, round head, full kegs, net | $4.50 |
| Structural, round head, broken kegs, net | 6.00 |
| Tank, 7/16-in. dia. and smaller, list less | 65% |
| Nuts: | |
| Hot pressed, square or hexagonal, blank or tapped: | |
| Full kegs up to 1-in., incl., list less | 65% |
| Larger, up to 3-in., list less | 65% |
| Less than keg or case lots, add to list | 10% |
| Washers: | |
| Wrought, full kegs, per 100 lb., list less | $4.00 |
| Wrought, broken kegs, per 100 lb., list less | 2.00 |
| Turnbuckles: | |
| With stub ends, list less | 20–10% |
| Without stub ends, list less | 55% |
| Chain: | |
| Proof coil, base, per 100 lb., net | $8.50 |
| Cast iron welding flux, per lb., net | .35 |
| Bronzing flux, per lb., net | .50 |

# MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

## Equipment Wanted

**Mass., Reading**—P. O. Box 96—14 or 16 in. lathes, bench lathes, small bench and foot presses, small shapers, millers, tools, etc.

**Minn., Minneapolis** — Strong-Scott Mfg. Co., Third St. S.—machine shop equipment for proposed 1 story, 100 x 360 ft. plant at Taft St. between Traffic-Kennedy Sts. Estimated cost $185,000.

**Ont., Fergus** — Beatty Bros., W. C. Beatty, Purch. Agt. (washing machines, pumps, specialties)—Firm arranged with Buckeye Incubator Co. of Springfield, O., to manufacture their incubators and brooders for Canada. Special equipment will be required.

**Ont., Gravenhurst** — Rainbow Craft Ltd. — interested in prices on complete machinery and equipment for proposed 1 story, 80 x 250 ft. boat building plant.

**Ont., Hamilton**—Tallman Brass & Metal Co., Cavell Ave., A. H. Tallman, Purch. Agt.—has taken over old foundry and is interested in equipment for the manufacture of bronze, aluminum castings and babbitt metals.

**Ont., Port Stanton**—F. Stanton—interested in prices on complete equipment for proposed general repair shop for small boats.

## Opportunities for Future Business

**Ala., Birmingham**—Crane Co., 2 South 20th St., awarded contract for a 1 story, 140 x 180 ft. shop building at 15th St. and 5th Ave. S.

**Calif., Emeryville** — Westinghouse Electric Co., Powell St., is receiving bids for the construction of a 1 story addition to factory. Estimated cost $25,000. Private plans.

**Calif., Fresno**—Commercial Iron Works, 2005 Broadway, acquired a site and plans the construction of a 25 x 130 ft. plant on Echo Ave.

**Calif., Los Angeles**—Oliver Farm Equipment Sales Co., West 11th St., awarded contract for the construction of a 120 x 153 ft. plant, 76 x 120 ft. warehouse and 40 x 120 ft. parts department building, all 1 story. Estimated cost $50,000.

**Calif., San Francisco**—Soule Steel Co., 916 Rialto Bldg., will build a 1 story shop and warehouse on Army St. Estimated cost $40,000. J. A. Cole, 2178 Oregon St., Berkeley, Engr. Work will be done by day labor.

**Calif., San Francisco** — Stella Bros., 1470 Howard St., manufacturers of caskets, are receiving bids for a 3 story factory. Estimated cost $50,000.

**Calif., Sausalito** — Italian American Motors Co., 604 Montgomery St., San Francisco, is receiving bids for the construction of a 1 story factory and shop. Estimated cost $15,000. McFarland & Moore, 126 Otis St., San Francisco, Archts.

**Conn., Darien** — Karl Melia Chevrolet Co., Post Rd., awarded contract for addition to auto sales and service station. Estimated cost including equipment $40,000.

**Conn., New Haven**—Connecticut Bearings Co., Inc., F. C. Bradley, 294 York St., will soon award contract for a 1 story, 40 x 60 ft. machine shop and 30 x 50 ft. garage, etc. Estimated cost including equipment $40,000. Private plans. Noted Oct. 16.

**D. C., Washington**—Bureau of Yards & Docks, Navy Dept., awarded contract for improvements to brass foundry at Navy Yard. $34,975. Noted Oct. 16.

**Mass., Cambridge** (Boston P. O.)—American Oil Co. of Massachusetts, 465 Rindge Ave., awarded contract for the superstructure of a 1 and 2 story garage and service station on Mount Auburn St. Estimated cost $60,000. Noted Aug. 21.

**Mass., Malden** — Malden Electric Co., 157 Pleasant St., plans the construction of a service station. Estimated cost $50,000. Private plans.

**Mass., Natick** — Mexican Petroleum Corp., Park Sq. Bldg., Boston, awarded contract for a 1 story service garage, etc., at East Central and Union Sts., here. Estimated cost $40,000. Noted Sept. 4.

**Mass., Pittsfield**—General Electric Co., E. A. Wagner, Gen. Mgr., will receive bids until Oct. 25 for the construction of a 1 story, 150 x 550 ft. transformer tank shop on Tyler St. Estimated cost $1,000,000. Private plans. Noted Oct. 16.

**Mass., South Boston** (Boston P. O.)—Greyhound Garage, c/o Eisenberg & Feer, 11 Beacon St., Boston, Archts., will build a 1 story addition to service garage at 571-583 East First St., here. Estimated cost $40,000. Work will be done by separate contracts.

**Mass., Springfield**—Bd. of Public Works, City Hall, received low bid for the construction of a 2 story service and repair shop on Taylor St. from W. A. Newton, Springfield. $121,500. McClintock & Craig, 458 Bridge St., Archts. Noted June 26.

**Mass., Whitman**—E. F. Carey, 55 George St., is having plans prepared for rebuilding bus garage destroyed by fire. Estimated cost $60,000. W. Littlefield, Concord St., Rockland, Archt. Noted Oct. 2.

**Mich., Detroit**—Wayne County Rd. Commission, 3800 Barium Tower, is having plans prepared for the construction of a 1 story, 60 x 100 ft. machine shop on Wyoming Ave. Estimated cost $40,000. Giffels & Vallet, 604 Marquette Bldg., Engrs. Equipment will be purchased later.

**Mo., Osage**—Missouri State Prison, c/o F. B. Jones, Dir. of Penal Institutions, Jefferson City, is constructing a group of buildings to include dormitories, administration building, boiler house, shops, etc., by convict labor.

**N. J., Elizabeth**—W. L. Finne, 1201 East Grand St., Archt., is receiving bids for a 1 story addition to factory for the manufacture of automobile bodies on Chestnut St., for Fischer & Dackerman, 1153 Chestnut St. Estimated cost $40,000.

**N. J., Jersey City**—J. Goldenberg, 80 Woodland St., Englewood, will receive bids about Mar. 1, 1931, for the construction of a 4 story, 90 x 150 ft. garage, etc., at Sip and Summit Aves., here. Estimated cost $250,000. C. Shilowitz, 26 Journal Sq., Jersey City, Archt. Noted Oct. 16.

**N. J., Maplewood**—LeRoy Schenck, 513 Valley St., postponed 2 story shop and garage. Estimated cost $40,000. R. B. Flatt, 600 Bloomfield Ave., Bloomfield, Archt. Project may go ahead in April, 1931.

**N. J., Plainfield** — Public Service Co., Ordinated Transport Terminal Bldg., Newark, is receiving bids for a 1 story, 100 x 170 ft. addition to garage here. Estimated cost $150,000. Private plans.

**N. J., Union City** — F. Romano, 352 New York Ave., postponed 2 story garage at 14th St. $155,000. J. G. Helmers, 145 Summit Ave., Archt. Project in abeyance. Noted Oct. 2.

**N. Y., Brooklyn**—Donigan & Nielson, 3rd Ave. and 24th St., manufacturers of automobile bodies, is having sketches made for the construction of a work shop. Estimated cost $40,000. S. L. Malkind, 93 Court St., Archt.

**N. Y., Brooklyn**—N. Mastranda, 363 East 29th St., plans the construction of a 100 x 110 ft. service garage at East 29th St. and Ave. D. Estimated cost $40,000. Lama & Proskauer, 391 Fulton St., Archts. Maturity spring or summer, 1931. Noted Oct. 9.

**N. Y., Brooklyn**—J. Sholnik, 729 Ave. T, will build a service garage at Adelphi St. and Atlantic Ave. Estimated cost $45,000. H. J. Nurick, 44 Court St., Archt. Work will be done by day labor and separate contracts.

**N. Y., Brooklyn**—D. H. Yeoman, 89-15 187th St., Hollis, is having sketches made for the construction of a service garage at 54th St. and 21st Ave. Estimated cost $50,000. J. A. Boyle, 367 Fulton St., Archt.

**N. Y., Flushing**—Brein Holding Corp., 247 Langford Ave., awarded contract for the construction of a 2 story, 125 x 192 ft. garage and storage building at 40th Rd. and Main St. Estimated cost $40,000. Noted Sept. 25.

**N. Y., Flushing** — S. Lax, 4556 171st St., plans the construction of a 189 x 275 ft. service garage at Willets Point and 36th Ave. Estimated cost $50,000. B. Braunstein, 163-18 Jamaica Ave., Jamaica, Archt. Maturity after Apr. 1, 1931. Noted Sept. 11.

**N. Y., New York**—A. J. C. Corp., 704 East 133rd St., plans a 2 story, 90 x 245 ft. garage and laundry at Barry St. and Burnett Pl. Estimated cost $250,000. P. J. Murray, 14 West 45th St., Archt.

**N. Y., New York**—Harrod Holding Corp., S. Kusnetz, Pres., 1101 Manor Ave., is having sketches made for a 2 story, 110 x 144 ft. service garage at Austin Pl. and Brady Ave. Estimated cost $70,000. J. Bleich, 4756 3rd Ave., Archt.

**N. Y., Tonawanda**—J. H. Williams Co., 400 Vulcan St., Buffalo, will soon award contract for the construction of a factory for the manufacture of wrenches and tools here. Estimated cost $50,000.

**O., Cleveland**—Cleveland Wire Works of National Lamp Co., C. J. Edwards, Engr., Nela Park, had plans prepared for the construction of a 1 story, 95 x 106 ft. garage on Chardon Rd. Estimated cost $40,000. Private plans.

**O., Cleveland**—Powerlite Switchboard Co., J. F. Jirka, Secy. and Treas., 4149 East 79th St., is having plans prepared for a 1 and 2 story, 50 x 122 ft. addition to factory and office. Estimated cost $50,000. H. K. Ferguson Co., Hanna Bldg., Archts. and Engrs.

**O., Norwood** (br. Cincinnati)—Jackson Box Co., 4927 Beech Ave., Cincinnati, awarded contract for the construction of a 1 story factory here. Estimated cost $100,000.

**Pa., New Castle**—Blair Strip Steel Co., G. D. Blair, Jr., Pres., Butler Ave. Ext., plans to rebuild steel plant destroyed by fire. Estimated cost $500,000. Engineer not selected. Maturity probably in November.

**Tex., Cleburne**—Gulf, Colorado & Santa Fe Ry. Co., Galveston, will soon receive bids for the construction of railway shops here, as part of general building program involving $4,000,000. F. Merritt, Galveston, Ch. Engr.

**Ont., Brockville**—Eugene F. Phillips Electrical Co. Ltd. Kingston Rd., awarded contract for additions to wire and electric plant, including new electrical shop, machine shop, boiler house, rubber room, braiding room, finishing shop, etc. Estimated cost $500,000. Noted Oct. 2.

**Ont., Fort William** — R. E. Mason, Francis Block, Archt., will receive bids until Oct. 29 for a 3 story technical school for Bd. of Education. Estimated cost $400,000. Noted Sept. 18.

**Ont., New Toronto** — Anaconda American Brass Co. Ltd., plans the construction of a 1 story, 80 x 400 ft. copper and brass tube mill. Estimated cost $100,000. Private plans.

**Ont., Niagara Falls**—Fowler Oil Burner Co. of Canada, Queen St., recently incorporated, plans to establish a plant for the manufacture of oil burners. A. H. Labrie, Managing Director.

**Ont., Toronto**—Flexlume Sign Co., Ltd., 1074 Queen St. E., awarded contract for a 2 story, 90 x 200 ft. addition to plant. Estimated cost $100,000. Noted Aug. 14.

**Que., Hull** — E. B. Eddy Co. Ltd., C. V. Caeser, Gen. Mgr., match manufacturers, is having plans prepared for first unit of bleaching plant and filtration plant on site of sulphite mill. Estimated cost $1,800,000. Private plans.

**Que., Montreal**—Crane Ltd., 1170 Beverly Hill Sq., awarded contract for the construction of a 180 x 330 ft. foundry.